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DR 306

HANDBOOK

FOR THE

12-PR. QUICK-FIRING GUNS.

1913.

By Command of the Lords Commissioners of the Admiralty.



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GENERAL REMARKS ON 12-pr. GUNS.

The types of 12-pr. gun used in the service are :—

12-pr. 12-cwt.	12-pr. 8-cwt.
12-pr. 18-cwt.	12-pr. 4-cwt.

The 12-pr. 12-cwt. gun is mounted either as an anti-torpedo boat gun in battleships, cruisers, and light cruisers on the S. II. or P. III. mountings or as part or the whole of the main armament of destroyers on the P. I., P. V., or P. VI. mountings.

The 12-pr. 18-cwt. gun is mounted as an anti-torpedo boat gun in more modern battleships and cruisers on the P. IV.* mounting. It was mounted as the main armament of some light cruisers on the P. IV. mounting (the original "Scouts"), but these ships have now been re-armed with 4" guns.

The 12-pr. 8-cwt. gun is mounted on the G. I. mounting and is supplied as a boat gun to older battleships, cruisers, and light cruisers. It is also used on the tops of turrets in older battleships, and in cruisers and light cruisers it has a fighting position inboard. The gun is also mounted on the G. I.* mounting as part of the main armament of "River" class destroyers.

The 12-pr. 4-cwt. gun is being introduced for light cruisers as a field gun. The description of this gun and carriage will be issued in a separate handbook.

Field Carriages have been made for each nature of 12-pr. gun, but the 12-pr. 8-cwt. is the only gun for which carriages have hitherto been made in large quantities.

CHAPTER I.

ORDNANCE Q.F. 12-PR. 12-CWT., A, MARK I.

Plate I.

The gun is made of steel; it consists of the A tube over which is shrunk the jacket, prolonged to the rear for the reception of the breech screw, and the B tube extending to the muzzle. Over the jacket and the B tube is shrunk the C hoop, which screws into the jacket and is attached to the B tube by a shoulder. The A tube is prevented from moving forward by shoulders between it and the B tube.

At the top and bottom of the jacket are two feathers, which form guides for the gun in the cradle. The under side of the jacket is provided with a horn to which are attached the piston rod and the running-out rods.

The right side of the jacket has a projection in the form of a bracket, to which is secured, by means of a hinge bolt, the carrier.

The chamber is slightly coned to facilitate extraction of the cartridge after firing.

PARTICULARS OF THE GUN.

Nominal Weight	-	-	-	-	-	12 cwt.
Length, total	-	-	-	-	-	123.6 inches.
Bore	{	diameter	-	-	-	3 inches.
		length	-	-	-	120 inches.
		capacity, including chamber and grooves	-	-	-	878 cubic inches.
Chamber	{	diameter { rear end	-	-	-	3.6 inches.
		front end	-	-	-	3.2 inches.
	{	length	-	-	-	15.44 inches.
		mean capacity of cartridge case	-	-	-	119 cubic inches.
Rifling, Mark I.	{	number of grooves	-	-	-	16
		depth of groove	-	-	-	.04 inch.
		width of grooves	-	-	-	.4 inch.
		total length	-	-	-	103.035 inches.
		width of lands	-	-	-	.189 inch.

Rifling is of Elswick section, and the twist is from 1 turn in 120 at the breech to 1 in 28 at the muzzle.

For guns of future manufacture and for existing guns (otherwise rifled) when repaired with new A tubes or through lined, the Mark II. rifling is adopted.

Rifling is of modified plain section straight from breech end of rifling to 85.035 inches from the muzzle, the remaining 85.035 inches increasing from 0, to 1 in 30 calibres at the muzzle.

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THE BREECH MECHANISM.

ALL 12-PR. GUNS.

Plates III. and IV.

The breech screw (a_1) is conical in shape for about two-thirds of its length from the front, the rear portion is cylindrical. On each portion are three rows of interrupted threads, those on the front portion alternating with those on the rear, so as to distribute the thrust better. One-sixth of a turn is required to screw it up. One of the flat surfaces of the rear portion of the breech screw is lapped out to allow the breech screw to freely enter the gun, portions of the gun being similarly cut away to receive the breech screw as it revolves round the carrier hinge bolt (a_2).

The screw is supported by a bronze carrier (a_3), a projecting arm of which enters an axial recess in the screw; a radial fixing screw (a_4) holds the screw to the arm longitudinally, its inner end works in a slot in the arm which admits of the turning of the screw circumferentially about the carrier and limits the turning.

The breech screw when unlocked is prevented from revolving on the carrier by the "catch retaining breech screw open" (a_5); the catch is a steel lever (a_6) pivoted obliquely in the bracket (a_7) and pressed forward by a spiral spring (a_8) placed in a recess in rear of the catch. The inner end of the catch is shaped to engage the slot in the flange of the breech screw (a_{12}), while a projection (a_{23}) is formed on its front face which bears on the face of the breech to force the inner end of the catch to the rear and release the breech screw when closing the breech.

Attached to the carrier is the "breech mechanism lever" (a_7); pivoted to this is the link actuating breech screw (a_8); this is in turn pivoted to a sliding block (a_9), in which works a movable metal bush (a_{10}). A stud (a_{29}) on the rear face of the breech screw engages in this metal bush.

The carrier is hinged on the right and here provides a cam (e_{12}) for actuating the extractor.

The extractor (e_1) passes through the right side of the gun and terminates at the rear end of the chamber in a claw, against which a portion of the rim of the cartridges engages. It is held in by the nut retaining (e_2), in which it is free to revolve. The outer end of the extractor is secured to the extractor lever (e_3) by a fixing screw (e_4). An axis pin (e_5), washer (e_7) and split pin (e_8) secure the actuating plate (e_6) to the extractor lever (e_3), which is furnished with a buffer (e_9), against which acts a spiral spring (e_{10}) lying in a recess and held in by a cover (e_{11}). An eccentric groove on the carrier (e_{13}), as the breech is opened, imparts motion to the actuating plate, which causes the extractor lever to work the extractor.

The spiral spring forms a buffer which prevents damage to the breech fittings by jar on the breech being swung open, and ensures the actuating plate being kept bearing in the eccentric groove. It also returns the extractor spindle to its normal position when the breech is closed.

THE STRIKER FOR 12-PR. 18-, 12-, AND 8-CWT. GUNS.

Plates V. and VI.

The striker consists of the following parts:—

Needle, with spindle, head,	Nut retaining.
firing pin, insulator, set	Trigger, with head, spiral
screw, and two nuts.	spring, and cap retaining.
Insulating bushes.	Steel head.
Insulating washers.	Sheath nut.
Sheath.	Elbow piece.
Main spring.	Leather washer.

The needle (b_2) is of steel, having an enlarged head (b_1) screwed to its front end to give a bearing on the striker sheath (b_1), while an insulator of vulcanite fibre (b_3) is screwed to the front of the head to prevent short circuit with the breech screw. Both insulator and head are prevented from unscrewing by a set screw (b_4).

The head is recessed to receive the firing pin (b_5). Two descriptions of firing pin are issued, one short and the other .03 longer. The firing pin is held in place by the spindle (b_2). Near the rear end of the spindle of the needle a screw thread is formed for the two nuts (b_6) which hold the needle firmly in its sheath.

Surrounding the needle is an insulating bush of ebonite (b_7). A leather washer (b_{10}) is fitted between the head of the needle and the sheath to prevent short circuit, while a second washer (b_{10}) is placed between the rear end of the sheath and the needle nuts for the same purpose. The striker sheath (b_1) is of steel, bored out to receive the needle and insulating bushes. On the exterior of the sheath at its front end is a circular projection recessed in rear to form a seating for the main spring (b_8), and having two small feathers upon its upper surface which engage into a broad featherway inside the striker recess in the carrier and prevent the striker from turning; the space between the feathers provides a gas escape in the event of a defective tube being used.

On either side of the exterior of the sheath a cocknotch (b_{10}) is cut, with one of which the rear (b_{12}) of the trigger (b_{12}) engages when the striker is cocked for percussion firing.

On the left of the sheath and at its rear end is a feather to ensure the correct attachment of the striker head and to prevent its turning on the sheath.

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The rear end of the sheath is threaded for the attachment of the sheath nut (b_{17}) and elbow piece (b_{18}).

The striker is actuated by a strong spiral spring (b_5) which is placed over the sheath, and is in compression between the front end of the sheath and the nut retaining striker (b_9). The nut retaining striker fits on the sheath in rear of the main spring. Around the exterior of the nut are interrupted collars (b_{20}) which agree with those in the recess in the carrier. Bevels are cut opposite the interruptions to form gas escapes.

A projection (b_{21}) on the left of the nut is hollowed to receive the trigger (b_{22}), and is screwed for the attachment of the retaining cap (b_{23}) which secures the trigger (b_{22}) in position. At the top and bottom of the rear face of the nut retaining striker (b_9) a slot is cut to receive a projection (b_{24}) on the front of the striker head by means of which the nut is locked in position.

The trigger, which is of hardened steel, consists of a short spindle (b_{25}) enlarged at its inner end and so shaped as to form a sear (b_{26}) to engage with the cocknotch of the sheath. A spiral spring (b_{27}) is placed over the spindle; the outer end of the spindle is threaded to receive a small knob (b_{28}) formed into a loop for the attachment of the hook of the firing lanyard.

The trigger is held in position by a "cap retaining" (b_{29}) screwed over the projection of the nut retaining striker.

The front face of the cap is flattened at (b_{30}), and bearing against the carrier, prevents the cap from unscrewing when the striker is in place.

The steel head (b_{31}) is recessed to fit over the sheath in rear of the nut retaining striker. It is feathered to the sheath to prevent it turning from its correct position.

On its under side is a projection (b_{32}) against which the safety stop (d_2) acts in forcing back the striker on opening the breech.

Behind the steel head is a leather washer (b_{33}), and in rear of this is screwed the sheath nut (b_{17}) which maintains the whole in place.

The sheath nut is secured in place, after screwing up, by means of a split pin. This is very important, as the slacking back of the nut may cause the striker to protrude when the breech is open, and the safety stop cam is to the rear.

The elbow piece (b_{18}) is of brass hollowed out and threaded internally to screw on to the rear end of the striker sheath and externally on the side arm to receive the nut of the cable of the firing circuit.

The end of the cable is provided with an insulated spring fork contact (b_{34}), which, when in place, grips the rear end of the needle and makes a good electric contact.

The protrusion of the striker when forward is to be between the limits .09 and .11 inch.

To gauge the striker, first see that the two needle nuts and the bronze sheath nut are screwed tightly up and the latter secured by its split pin. See insulating washers in place. Open the breech and release the "catch retaining breech screw open" and revolve the breech screw into the locked position. The protrusion is then measured by means of the "gauge striker protrusion" which is applied to the bottom of the recess in the front face of the breech screw, the striker being pulled to the rear, but only sufficiently to take up wear in the interrupted collars.

NOTE.—Where special percussion firing gear is fitted the trigger must be eased.

The striker should then be examined to ascertain that the needle is within the face of the bush in the breech screw when the breech is open, the striker complete being pressed to the front during this operation.

The protrusion of the striker may be adjusted by the size and number of the leather washers between the head of the needle and the sheath, or by using a different sized firing pin.

Two sizes of firing pin are supplied, one being .03 inch longer than the other.

It is important that the steel head should be bearing against the nut retaining striker when gauging the protrusion of the striker, in order that the vulcanite insulator, bearing against the breech screw, shall not govern the protrusion.

A combined cocking handle and spanner is supplied for use with the 8-cwt. field gun in place of the elbow piece.

The *safety stop* consists of a short vertical spindle (d_1), which passes through the arm of the carrier. It has at its upper end a small cam (d_2), which is secured to the head of the spindle by a screw (d_3) and set screw (d_4), and it is necessary to see that the set screw is in place; this cam lies directly in front of the *steel head* of the striker, and at the lower end of the spindle is a \perp -piece (d_5), at the end of which is a stud (d_6) working in a cam groove (d_7) on the breech mechanism lever. By moving the breech mechanism lever the \perp -piece is revolved, so causing the cam at the upper end of the safety stop to move in such a manner that either the striker is withdrawn or is allowed to go forward. When, on opening the breech, the breech mechanism lever has revolved the safety top sufficiently to withdraw the striker, it is secured against movement by a stud (d_8) on the inner arm taking in a recess in the sliding block which prevents it being moved until the sliding block again travels over to the left.

In later manufacture of safety stops the fixing screw is prevented from turning, when in position, by means of a locking plate.

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Where guns are specially fitted for percussion firing the following modifications are made to the striker and breech mechanism:—

- (1) The loop of the trigger is removed and a sleeve fitting over the trigger casing and secured by a split pin substituted.
- (2) A washer is placed over the sheath between the nut retaining striker and the mainspring.
- (3) A hole is drilled in the nut retaining striker and a small plunger is fitted on the carrier. This plunger takes in the hole in the nut retaining striker and prevents the striker from turning unless the plunger is withdrawn.
- (4) A new upper cam is fitted to the safety stop.
- (5) A new cocknotch is cut in the sheath in rear of the other cocknotches. When the breech is opened, owing to the increased movement of the striker due to the larger cam on safety stop, the trigger engages in the rear cocknotch, the striker being thereby cocked automatically. The washer on the sheath increases the compression of the mainspring, and the same original force of blow is given for the reduced travel of the mainspring. It is impossible to draw the striker so far to the rear that the trigger can take in the front cocknotch in the sheath, because the mainspring is in full compression before then.
- (6) A hole is drilled through the sleeve, trigger casing, and trigger. When the trigger spring is removed for electric firing a split pin is inserted through this hole, thus preventing any movement of the trigger. When in percussion firing, this split pin is kept in another hole in the sleeve.

The catch retaining breech mechanism lever closed (a_{11}), consists of a steel lever supported on the under side of the carrier by a securing screw. The rear end of the lever is formed into a lip. The securing screw passes through an oblique hole in the lever and is prevented from unscrewing as follows:—

The screwed end is split and formed into a conical hole in which is placed a conical steel pin, so that on screwing up, the pin, being forced within the screw, expands the latter and ensures a tight fit. A steel washer and volute spring are placed between the head of the securing screw and the lever. This spring allows a small vertical movement of the lever when the B.M. lever is drawn to the rear.

In order to prevent wear, the outer face of the breech screw of all 12-pr. guns round the recess (a_{12}) for the retaining catch is fitted with a hardened steel plate, which is dovetailed into

the breech screw and secured by two fixing screws. This is shown on Plate III.

On the right of the gun in front of the carrier is screwed a hardened steel plate secured by a set screw. This plate finally brings the carrier to rest on opening the breech. It can be replaced when worn.

LUBRICATION OF BREECH MECHANISM.

Purpose.	No. of Holes.	Position.	Nature.
For lubricating carrier hinge pin.	1	On carrier hinge pin (a_{10} , Plate III.).	Oil screw.
Sliding block and gudgeon pin.	1	On carrier (a_{10} , Plate III.).	" "
Carrier arm	1	On breech block -	" "
Breech mechanism lever hinge bolt.	1	On carrier -	" "
Hinge of link actuating breech screw.	1	On link -	" "
Washer of carrier	1	On carrier (a_{30} , Plate III.).	" "

NOTE.—The breech blocks of the 12-pr. 12- and 8-cwt. guns are interchangeable. The breech block for the 12-pr. 18-cwt. gun is larger than those for the 12- and 8-cwt. guns.

TO ASSEMBLE THE PARTS.

THE STRIKER AND MAINSPRING FOR 12-, 18-, AND 8-CWT. GUNS.

1. Place the mainspring over the steel sheath and, where fitted, the special washer; place the nut retaining striker over the mainspring.

2. Place the steel head over the sheath so that the small projection on the steel head fits into one of the two deep slots in the nut retaining striker.

3. Place leather washer and nut for sheath over rear end of steel sheath and screw up tight; insert safety pin.

4. Place washer and bush insulating over needle and insert the whole into front end of steel sheath.

5. Insert trigger, trigger spring, and screw on cap and loop. Where fitted place on and secure sleeve instead of loop.

6. Screw on elbow piece.

THE EXTRACTOR.

12-, 18-, AND 8-CWT. GUNS.

1. Place extractor through the right side of the gun, screw in nut retaining. See extractor on proper slew.

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2. Assemble buffer and spring and screw on cap. Place extractor lever over end of extractor. Secure extractor lever with fixing screw to extractor.

3. Place actuating plate and axis pin and secure with washer and pin.

THE BREECH MECHANISM.

12-, 18-, AND 8-OWT. GUNS.

1. Secure carrier (a_1) and washer (a_{11}) to gun with hinge bolt (a_2), washer (a_{14}), and keep pin (a_{16}); insert both lubricating screws (a_{18}) and (a_{20}).

2. Place bush sliding block (a_{10}) in sliding block (a_9), lubricating hole up and groove to the rear and down; insert lubricating screw (a_{18}).

3. Secure link actuating breech (a_8) to sliding block with axis pin (a_{19}) and fixing screw (a_{20}).

4. Place breech mechanism lever (a_7) over its own axis pin (a_{21}) and over link axis (a_{22}) and secure with nuts (a_{23}) and (a_{24}) and keep pins; insert lubricating screw (a_{25}).

5. Insert catch retaining breech screw open (a_5), with spring (a_6), and place bracket (a_{27}).

6. Insert safety stop (d_1), secure cam (d_2), with fixing screw (d_3) and set screw (d_4).

7. Place breech screw on carrier arm and secure with fixing screw (a_4). Where fitted secure spring plunger.

8. Insert striker.

9. Insert catch retaining B.M. lever closed.

10. Insert hooks supporting cable.

ACTION OF THE MECHANISM.

ALL 12-PR. GUNS.

Suppose the gun to have been fired, on pulling back the handle of the breech mechanism lever (a_7) the following actions take place :—

1. The stud (d_3) on the safety stop engages in the groove on the breech mechanism lever, and the stop is revolved, the upper portion (d_2) of it engaging on a projection on the steel head of striker (b_{27}) causes the latter to be drawn to the rear, thus breaking the contact between the needle and tube.

2. The sliding block (a_{17}), worked by the actuating link (a_8), commences to move to the right, locking the safety stop (d_1) and bringing with it the stud on the rear face of the breech screw (a_{28}) thus rotating it.

3. The retaining catch (a_5) is forced by its spring (a_6) into a slot on the circumference of the breech screw, thus locking the screw to the carrier.

4. The breech screw and carrier now revolve round the carrier hinge bolt (a_3), the cam at the hinge (e_{12}) bears on the actuating bolt (e_3) causing the extractor to work.

5. The breech is closed by swinging round the lever breech mechanism to the left. As the retaining catch comes in contact with the breech of the gun, it is forced back, leaving the breech screw free to turn, the sliding block worked by the link moves to the left and the breech is screwed up.

6. The stud on the safety stop engages in the groove on lever, causing the safety stop to revolve, the mainspring asserts itself, and the striker moves forward, bringing the striker into contact with the tube.

A spring catch retains the breech mechanism lever in its closed position, in order that, when the gun is at elevation and percussion firing is being used, the breech mechanism lever may not fall to the rear.

THE FIRING GEAR.

All guns can be fired either electrically or by percussion.

Originally the intention was to use percussion firing as an alternative in the event of failure of the electrical gear, the guns being fired by means of a lanyard hooked on to the loop of the trigger.

Owing to trouble with electrical gear in T.B.D.s a percussion gear has been designed for 12-cwt. guns on P. V., P. VI., and P. I. mountings (except for 27 knot T.B.D.s). It is intended to retain the electrical gear with these mountings as an alternative to the percussion gear.

ELECTRICAL FIRING.

The current is supplied either by dynamo or battery. The table below shows the method of supply to each mounting. In the case of the S. II. and P. III. mountings, some ships have dynamo and others battery firing.

Mounting.	Whether fitted with dynamo firing.	Whether fitted with battery firing.
12-cwt. gun on P. I. mounting	No.	Yes.
" " S. II.	Yes.	Yes.
" " P. III.	Yes.	Yes.
" " P. V.	No.	Yes.
" " P. VI.	No.	Yes.
18-cwt. " P. IV.	No.	Yes.
" " P. IV.*	Yes.	No.
8-cwt. " G. I.	No.	Yes.
" " G. I.*	No.	Yes.

NOTE.—The P. IV. mounting was fitted in some light cruisers only; these have now been re-armed with 4" guns.

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Dynamo Firing.—Current is led on to two five-way boxes on the mounting. The distribution of the current from the five-way boxes is shown in the various diagrams of the circuits.

Battery Firing.—The battery for later mountings consists of 15 dry cells joined in series and stowed in a watertight galvanised steel box, patt. 1539. This box carries three terminals, two at one end joined in parallel and one at the other end connected to earth on the mounting. Of the two terminals in parallel, one feeds the pistol grip and the other feeds the dial and telescope illuminating lamps. In some of the earlier vessels the three-cell battery is still fitted.

Method of packing the Cells.—Three strips of thick india-rubber are placed on the bottom of the box. The fearnought lining at the ends of the box is cut away to make room for the cells and indiarubber sheeting substituted. Twelve cells in three rows of four are then placed on end in the box with indiarubber sheeting between their sides, and are connected in series. Batteries are placed to protect the terminals of the cells and on the batteries is laid a wooden shelf on which are laid the remaining three cells on their sides. Wooden battens keep the last three cells in place. One terminal of the battery is joined to each end of the box. The lid is then secured by two butterfly nuts, an indiarubber washer making the joint watertight.

The battery boxes are held in skeleton brackets bolted to the mountings.

Usually two batteries are supplied to each mounting.

The position of the batteries are given in the following table:—

Mounting.	Position of Main Battery.	Position of Auxiliary Battery.
12-cwt. gun on P. I. mtg.	On the right of the mtg.	In rear of recoil cylinder in most cases.
" " S. II. "	" " " "	" "
" " P. III. "	" " " "	" "
" " P. V. "	" left " "	" "
" " P. VI. "	" " " "	" "
18-cwt. " P. IV. "	" " " "	On the right of the mounting.
8-cwt. " G. I. "	In rear of mounting	No auxiliary battery.
" " G. I.* "	" " " "	" "

A box is attached to all mountings, except the G. I. and G. I.* mountings, in which are stowed the spare striker and, when not component of the mounting, the leads for the auxiliary circuit, also the auxiliary circuit in S. II., P. III., G. I., G. I.* and earlier P. I. mountings are portable and consist of two leads of flexible wire attached to a pistol grip, pattern 1548. When this circuit is in use one lead is screwed to the striker and the other

to the battery or five-way box (S. II. and P. III.). The pistol grip, pattern 1548, can be put at "safe" by means of a thumb-push on top of the pistol. When this push is to the rear the word "safe" stamped on the pistol shows and the trigger cannot be moved. To press the trigger the push must be to the front.

In the P. IV., P. V., P. VI., and later P. I. mountings the auxiliary circuit is permanently shipped. Two pistol grips, pattern 1547, are fitted to the mounting. The handle of the auxiliary pistol grip being roughened to distinguish it, and both pistols are hinged in front so that the one not in use may be depressed out of the way.

Diagrammatic sketches of the circuits will be found with the plates of the various mountings.

PERCUSSION FIRING.

All 12-pr. guns on P. V., P. VI., and P. I. mountings (without training gear) will be fitted with special percussion firing gear. A separate pistol grip is fitted which is connected mechanically to the trigger of the striker. Other 12-pr. guns can be fired by percussion by means of a lanyard hooked on to the loop of the trigger. A description of the percussion firing gear is given under the headings of the different mountings.

SAFETY ARRANGEMENTS.

Electrical.—The guns cannot be fired till they are within one inch of run-out position, because there will be no contact between the parts of the run-out contacts on the gun and cradle. Exceptions are G. I. and G. I.* mountings and auxiliary circuits of S. II., P. III., and earlier P. I. mountings.

The guns cannot be fired till the breech threads are properly locked since the striker does not make contact with the tube till this has been effected.

Breech Contacts.—The P. V. and P. VI. mountings have contact pieces, one on the carrier and the other on the breech block. These contacts break the circuit till the breech threads are properly locked.

Percussion.—No gun can be fired till the breech is properly closed. Even if the trigger were released the striker would be prevented from touching the tube by the safety stop.

Where special percussion gear is fitted there are the following additional safety arrangements:—

- (1) The guns cannot be fired till they are properly run out, because until they are out the sleeve on the trigger does not engage with the toe on the firing mechanism.
- (2) Breech cannot be closed if the trigger is pulled to the rear or the mechanism has not been returned to its original position after firing.

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The sleeve on trigger engages with the toe on the firing mechanism and so prevents the breech from being closed.

NOTE.—No danger need be apprehended from the opening of the breech screw of 12-pr. Q.F. guns on firing. No movement takes place until the gun commences to run out after recoil, the tendency then being for the breech mechanism lever to remain behind and thus to impart its motion to the breech screw, which action is accentuated as the elevation of the gun is increased.

To test the pull-off of the pistols (electric). In each complete pistol-grip contact must be made by a pull of not less than 8 lbs. or more than 10 lbs. applied to the trigger by means of a trigger test with roller attachment in a direction parallel with the upper face of the pistol grip.

CARE OF CIRCUITS.

Attention must be paid to the following points:—

- (1) That spills of all contacts are free from oil and a tight fit in their sockets.
- (2) That collars are free on the terminals, and that leads are not twisted as the collars are screwed up.
- (3) That collars are screwed up taut.
- (4) That circuits are properly secured in their clips before firing. It may be found advantageous to secure those on the breech with a seizing, taking care that sufficient slack is allowed for the operation of the breech mechanism.
- (5) That night sight switches are properly connected up.
- (6) That a circuit is never left hanging loose, so that its bare end could make earth.
- (7) That the circuit is unscrewed from the striker before the latter is unshipped, otherwise the circuit may be broken.
- (8) That the caps are placed on contacts when a circuit is disconnected from a three- or five-way box.
- (9) Circuits are to be tested weekly, monthly, and before firing. See Torpedo Drill Book, 1912, pages 183, and on.

CHAPTER II.

THE MOUNTINGS FOR THE 12-PR. 12 OWT. GUN.

THE PEDESTAL, MARK I, MOUNTING FOR
TORPEDO BOATS AND TORPEDO BOAT
DESTROYERS.

Plates VII., VIII., IX., X., and XI.

The Pedestal (Plate IX).—The pedestal is built up of steel plate (a_1) in the form of a cone. A steel bottom plate (a_2) is secured to its base by three screw bolts. A forged steel socket (a_3), having a hardened cast-steel block (a_4) in its centre, and a gun-metal bush (a_5) is attached to the bottom plate by six screw bolts. A forged steel bush, also bushed with gun-metal (a_6), is secured to the upper part of the pedestal for receiving the carriage.

Three holes are provided in the base of the cone for draining purposes.

The Carriage.—The carriage (a_1) is in the form of the letter Y and is made of forged steel; it consists of two trunnion bearings for receiving the cradle and a long pivot pin, the latter fits into the pedestal and forms the pivot upon which the gun, &c. revolves.

A hardened steel block (a_2) is wedged in to the base of the pivot to form a bearing surface.

The cradle is secured in the trunnion bearings by two cap-squares, secured into their places by pins attached by chains to two studs.

The Elevating Gear (Plate X).—Elevation is by wheel. The pistol grip, shoulder piece, and elevating gear are attached to a gun-metal bracket that is secured to the carriage by three screws. The pistol grip is attached to the elevating gear bracket by two fixing screws.

The elevating gear bracket forms a box for the reception of the elevating mechanism. This consists of a worm wheel (g_5), attached to which by feathers are four manganese bronze washers (g_6); alternately with these metal washers are four steel washers (g_8) that are secured on to the worm-wheel spindle (g_9) by feathers. The end of this spindle nearest the gun has the elevating pinion attached to it by featherways and split pin. This pinion gears into the elevating arc on the cradle. Between the worm-wheel and the elevating bracket, and attached to the worm-wheel spindle by featherways, is a steel washer (g_7). The washers in the worm-wheel are kept in position by a steel plate cover (g_{10}) a Belleville spring washer (g_{11}), a screw nut (g_{12}), a check nut (g_{13}), and a split pin (g_{14}).

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Into the worm-wheel gears a worm (g_{13}), that terminates at its lower extremity in a bevel pinion; these are supported on a steel collar (g_{17}) by the worm spindle (g_{18}), and are secured to the latter by a screw (g_{16}). In this pinion gears another bevel pinion on a shaft (g_{20}) that carries at its other end the elevating wheel (g_{22}) which is secured by a split pin (g_{23}). A cover (g_1), attached by five bolts (g_2) to the bracket protects this gear and affords support to the elevating shaft pinion (g_3) and the elevating shaft (g_{20}). Oil screws and channels are provided for the elevating worm shaft (g_{10}), elevating shaft pinion (g_4), elevating shaft (g_{21}) and worm-wheel (g_5).

A fixed stop on the carriage taking up against the cradle limits the elevation of the gun to 18° .

A stop on the fore part of the carriage taking up against the cradle limits the depression to 4° .

The Elevating Clamp.—A hinged stop, kept in place by a pin, can be put down so as to engage round one of the spokes of the elevating wheel, and so hold the gun in elevation.

The Training Gear.—In the earlier mountings this is done by the shoulder piece.

Training gear has been fitted to some of the mountings. The training rack fits on the top of the pedestal, and is secured to the upper metal bush. The gear itself is similar to that described for the S. II. mounting, with the following exception: the training wheel is geared to the training shaft by means of two bevel wheels instead of being secured to the training shaft direct, as in the S. II. mounting.

Adjustment of Training Gear.—Where no training gear is fitted, the training clamp is set up to the requisite tautness. Where training gear is fitted, play in the worm can be taken out in the same way as described for the S. II. mounting.

The Training Clamp (Plate IX).—Consists of a screw clamp (t_2), two spring washers (t_6), and a friction block (t_0), encased in a metal bracket (t_1), secured to the pedestal with four steel fixing screws. The friction block is limited in its travel by a guide screw (t_4). To secure the carriage the clamp handle (t_3) is set up, this causes the friction block to bear hard against the carriage (a_1).

Limit Stops for Training.—Two training stops are bolted on to the pedestal, whilst another, fitted with a hinged pawl, is bolted into the centre of the rear of the carriage, or as required.

The Cradle, Recoil Cylinder, and Spring Box combined.—The cradle, recoil cylinder, and spring box combined (c_1) is a single gun-metal casting, and to it are attached the elevating arc and sighting gear.

The gun rests in the cradle in a collar, formed at the front end; featherways are cut in the top and bottom of the collar in which work the guide feathers on the gun.

For lubricating the gun bearing surfaces an oil screw is fitted on the lifting hole plug. To ensure the circulation of the oil, oil grooves are cut on the inside of the cradle.

A tank is formed in the casting on the right side of the cradle for the supply of liquid to the recoil cylinder, and a communication is made from the tank to the front end of the cylinder, so that if any leakage takes place from the glands of the cylinder, liquid will flow from the tank to replace it. It is fitted both with a filling hole and plug with leather washer, and a cleaning hole and plug with leather washer. The liquid used in the recoil cylinder is equal parts of glycerine and water.

The recoil cylinder is formed at the rear end of the cradle underneath the breech of the gun, it is provided with an accurately fitted piston (h_1) carrying a manganese bronze ring (h_2), and a valve key (h_{16}) of rectangular section, which is fixed to the bottom of the press by a fixing bolt (h_{17}), with leather washer, and carries a projection on its front end that engages in a hole in the front end of the cylinder. A port cut in the piston travels along the valve key when the gun recoils. The key varies in shape on the top edge, so that although the liquid will pass freely through the port at the commencement of recoil, the port is gradually closed towards the end; the form of the key is in fact such that the velocity of the liquid through the port is approximately uniform during the whole of the recoil; by this means a uniform pressure is obtained in the cylinder. The piston rod is secured to a horn on the gun by two screw nuts (h_3) and a keep pin (h_4). The liquid is confined in the cylinder by means of the cylinder closing plug (h_5), which is on its inner side packed with a U-leather (h_6) and a metal ring (h_8), and on the outer side by cotton packing (h_{11}) and gland (h_{10}).

The cotton packing retains the liquid in the cylinder when the gun is at rest, whilst the U-leather does this duty when pressure is set up due to recoil.

A leather washer (h_7) is placed between the cylinder and the plug before screwing up. A controlling plunger (h_9) is screwed into the front end of the cylinder and a hole is bored in the piston rod to receive it; during recoil the liquid is forced into the hole in the piston rod through a small hole (h_{13}) in the neck of the piston; on return into the firing position this liquid has to be displaced by the controlling plunger. At first the small part of the plunger is in the piston rod, the liquid can therefore escape through the small annular space round the plunger; later, when the thicker part of the plunger enters the piston rod it can only escape between the flat cut-away portion of the plunger (h_{14}) and the piston, sufficient resistance is thus formed to allow the gun to run gently into the firing position after recoil. The cylinder is in communication with the tank above it in order to fill it with liquid, it is also provided with a draining (h_{12}) and an air plug (h_{15}), each with a leather washer. Its capacity is about 7 pints.

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INSTRUCTIONS FOR FILLING.

Depress the gun muzzle and fill through the hole on the right side of the cradle until the liquid overflows through the air hole in the same side. Replace the air plug and fill until the liquid overflows. Shake the gun in elevation and refill if necessary. When the level of the liquid no longer falls on shaking the gun, replace the filling plug.

The Spring Box.—The spring box is immediately in front of the hydraulic cylinder. The spring compressor (s_2) is a gun-metal casting screwed to receive the compressor bolt (s_3) which passes through the spring plate (s_5); two springs (s_1) of rectangular section, with a metal distance piece (s_4) between them to guide them and prevent them from bending whilst being screwed up, are placed on the compressor (s_2), and are screwed up to their initial compression by means of the compressor bolt (s_3). The compressor bolt is provided with a stop (s_7) to prevent too much initial compression being put on the spring. A crosshead (s_6) carrying the running-out rods fits into the front end of the spring box before the springs, the rods carrying feathers which fit into featherways on the crosshead. The running-out rods are attached to the horn at the rear of the gun by screw nuts, and are secured just in rear of the cradle by two spring forelocks. On recoil the horn at the rear of the gun carries the running-out rods and crosshead with it to the rear, thus further compressing the springs; after recoil the springs assert themselves and run the gun out again into the firing position.

The spare springs are kept on their compressor and ready to be shipped into place without the labour of screwing them up.

The internal length of the cylinder is 12½ inches; possible recoil, viz., metal to metal, 12 inches.

In their initial state each running-out spring is compressed from 17·5 inches to 12·5 inches with a pressure of 800 lbs., at 11 inches additional compression on recoil the pressure becomes about 3,360 lbs. to run the gun out again.

Lubrication :—

Purpose.	No. of Holes.	Position.	Nature.
For lubricating—			
Footstep bearing of pivot.	1	On fork of Y of carriage (see Plate X.).	Oil screw.
Trunnion bearings	2	On capsquares	"
Cradle and gun	1	On cradle	Lubricator.
Elevating hand-wheel shaft.	1	In cover for elevating gear bracket.	Oil screw.
Bearing of elevating worm-wheel shaft.	1	Elevating gear bracket.	"

Purpose.	No. of Holes.	Position.	Nature.
Elevating worm shaft and bearing.	1	Elevating gear bracket-	Oil screw.
Training hand-wheel, shaft, and bearing.*	1	Bracket carrying training wheel shaft.	Oil hole.
Deflection gear of sight.	3	On sight between deflection dial and telescope holder.	Oil holes.
Range gear of sight.	1	On sight between range dial and telescope holder.	Oil hole.

* Where training gear is fitted.

Firing Gear.—The earlier P. I. mountings have circuits identical with that shown on Plate XII. for the S. II. mounting for battery fire.

Where training gear is fitted a thumb press on the elevating wheel takes the place of the main pistol grip. In some cases the later P. I. mountings have a double pistol grip.

The auxiliary circuit is kept shipped, one end being connected to the auxiliary battery, and the other end to a dummy connection on the breech ring.

The percussion firing gear is similar in principle to that described for the P. VI. mounting.

The Sights.—Telescopic on the left side only.

THE S. II. MOUNTING FOR BATTLESHIPS, CRUISERS, AND LIGHT CRUISERS.

The Carriage consists of a forged steel bracket (a_1) provided with trunnion bearings for the cradle which is secured with cap-squares (a_2) by means of a pin, chain, and eye. The lower portion terminates in a circular base plate with a central boss fitted with an adjustable pivot (a_3). The cradle rests in two trunnion bearings of the carriage.

The arms of the carriage have been strengthened by means of screw plugs, which pass through the trunnion bearing and screw into the trunnions of the cradle; they have a deep flange on outer lower side, faced with metal to prevent metal binding, which flanges bear against the arms of the carriage and prevent them from opening out. The plugs are secured to the trunnions by set screws. The left screw plug has part cut away from the outer face to allow clearance for the sight bar.

The gunmetal pivot (a_3), with hard steel bearing piece is fitted and screwed into the boss in the base of the carriage, and is adjusted so that the weight of the gun and mounting is just supported while the circular flange on the pivot plate (a_4) is clear both of the corresponding flange on the carriage and the lower part of the clip ring (a_5). The pivot is secured in

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position by a set screw (a_9). A bearing of hard steel (a_{12}) supported on a pair of spring washers and secured by a nut (a_{11}), and split pin, takes the weight of the gun and mounting. The pivot plate (a_4) is secured to the ship's structure by means of a holding-down ring. Round the flange (a_1) of the pivot plate is a split metal ring (a_{13}) held in place by the clip ring. The clip ring is of manganese bronze in two parts bolted together at the lugs by steel bolts. It engages the flanges of the carriage and pivot plate and prevents the mounting from lifting when the gun is fired. Keep plates on top of the clip ring, assist in keeping the ring together. The clip ring can be made rigid with the pivot plate as follows:—Three clamping screws 120° from each other, bear on spring washers, bearing against small steel plungers which bear against the split metal ring (a_{13}), which in its turn bears against the flange (a_1) of the pivot plate. The upper part (a_3) of the pivot plate is cut to take a training rack.

The Elevating Gear.—Elevation is by shoulder piece secured to the left side of the mounting. The mounting is constructed to allow 20 degrees elevation and 10 degrees depression. Elevation is limited by the bottom of the spring box taking against a cut away part of the base plate, depression is limited by the length of the elevating clamping arc.

The Elevating Clamp (Plate XIII).—A steel arc (c_1) is bolted to the left side of the carriage which engages with a clamping bolt (c_4), fitted to the cradle, through the washers of an automatic clamp. A handle (c_2) turns the bolt (c_4).

An automatic clamp is fitted to hold the gun in elevation when the gun recoils. Attached to the front compression plates of the running out springs is a rod (c_3) connected at its rear end to a crank (c_5). This crank works on a threaded portion of the clamping bolt (c_4). Between the crank and the elevation clamping arc are two spring washers. Outside the clamping arc is the clamping handle (c_2).

Action:—The clamping handle should be set up moderately taut, but so that free elevation is obtained. On the gun recoiling the rod (c_3) comes to the rear turning the crank (c_5) which moves outwards on the threaded part of (c_4), so compressing the spring washers against the clamping arc (c_1), and thus holding the gun in elevation.

The Training Gear (Plate XIII).—The training mechanism consists of a worm (t_1) feathered to a short shaft to which is connected the training shaft (t_2). The connection between worm shaft and training shaft is an universal joint (t_3). The worm shaft is supported in bearings on a bracket attached to the left of the mounting. Thrust is taken by ball bearing rings (t_4) held in place by bushes (t_5). The rear end of the training shaft is supported in a gymbal bearing (t_6) on a bracket attached to the shoulder piece. A preponderance weight (50 lbs.) is fitted on the gun in front of the C hoop to balance these modifications.

Adjustment of the Training Gear.—Play in the worm may be taken out as follows: unscrew set screws securing bushes (t_6), and screw up on these bushes, then screw up these set screws.

NOTE.—This does not eliminate wear between the worm wheel and worm.

The Training Clamp.—When the three screws securing the clip ring are set up the training gear is rigid. By easing up on these three screws the mounting may be pushed round by hand. Great care must be taken to set up equally on the three screws.

Training Limit Stops.—An arm is bolted to the carriage and bends down over the training rack. Taking against two stops on the fixed structure this arm limits the arc of training.

The Cradle, Recoil Cylinder, and Spring Box combined are similar to those of the P. 1 mounting. The shape of the spring box is different. Length of recoil is 6.5 inches.

Lubricating:—

Purpose.	No. of Holes.	Position.	Nature.
For lubricating:			
Cradle and gun	1	On cradle	Lubricator.
Trunnion bearings	2	On capsquares	Oil screws.
Pivot bolt and bush	1	On revolving bracket	Oil plug.
Training gear	1	On training worm cover	Lubricator.
Training worm shaft	2	On training worm bushes	Oil holes.
Range worm of sight	1	On range gear bracket on sight.	Oil hole.

The Firing Gear.—Diagrams of the circuits for both battery and dynamo firing are shown on plate XII. When using the auxiliary circuit in dynamo firing one lead is connected to the auxiliary five-way box.

The Sights.—Telescopic on the left side only.

To assemble the Mounting.—The holding-down ring being already in place:—Place on the pivot plate with one of the holes in the pivot in line with the locking bolt. Tighten up pivot plate by screwing to left with the dismantling handspike, then screw up locking bolt, and secure to pedestal by holding-down bolts. This secures the pivot plate. (The pivot plate must have its parts assembled before it is lifted into position.) Slack up the pivot bolt in the base plate, lift carriage on to pivot plate. Assemble and place on clip ring, then adjust pivot bolt. Lift on gun and cradle complete. Assemble training gear.

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To remove the gun and mounting complete :—

Strip the training gear and remove the clip ring.

Hook the purchase on to the lifting bolt of the cradle and pull up.

The pivot plate can be removed by unscrewing the securing bolts and locking bolt, and then turning the pivot plate into the unlocked position by means of a handspike, after which it can be lifted out.

To remount the whole reverse the above procedure.

THE PEDESTAL MARK III. MOUNTINGS FOR BATTLESHIPS, CRUISERS, AND LIGHT CRUISERS.

Plate XIV.

The Pedestal is a steel forging flanged to bolt to the deck.

A hardened cast steel block is let into the centre of the hollow of the pedestal, a corresponding hard steel piece is let into the centre of the bottom of the pivot.

These two blocks form the bearing surface on which the gun trains. The pedestal is provided with two metal bearing bushes, an upper and a lower. These bushes are turned to fit the pedestal closely. Grooves are cut on the insides of the bushes for lubricating purposes. A drain screw screws into the bottom of the pedestal.

It will be seen from the plate that the mounting is designed to fit close to the ship's side, thereby enlarging the arc of training.

The Carriage is of forged steel and is in the form of the letter Y, it consists of two trunnion bearings for receiving the cradle and a long pivot pin. The latter fits into the pedestal and forms the pivot upon which the gun revolves. The cradle is held down by two capsquares of the usual type.

The Elevating Gear.—Elevation is by shoulder piece and the gear is identical with that of the S. II. mounting.

The Elevating Clamp is the same as in the S. II. mounting, including the automatic clamp.

The Training Gear is now fitted similar to that fitted in the S. II. mounting, except that the training rack fits over the top of the pedestal, and is prevented from jumping by steel strips screwed into the pedestal above it.

Adjustment of the Training Gear.—Play in the worm can be removed in a similar manner to that described for the S. II. mounting.

The Training Clamp.—A clamp similar to that described for the P. I. mounting is fitted.

Training Limit Stops.—An arm bolted on to the carriage bends down over the training rack. Two bolts are secured to the pedestal, and the arm taking against them limits the training.

If required to increase the limits of training the bolts can be raised.

The Cradle, Recoil Cylinder, and Spring Box combined.—These are identical with those of the S. II. mounting except that the position of the drain plug for the recoil cylinder is on the right lower side of the cylinder. This prevents the drain plug and bolt securing valve key being mistaken for one another.

Lubrication:—

Purpose.	No. of Holes.	Position.	Nature.
For lubricating:			
Cradle and gun	1	On top of cradle	Lubricator.
Trunnion bearing	2	On capsquares	Oil screws.
Foot-step bearing of pedestal.	1	On outside of pedestal	Lubricator.
Training gear	1	On training worm cover	Lubricator.
Training worm shaft	2	On training worm bushes	Oil holes.
Range worm of sight	1	On range bracket on sight.	Oil hole.

The Firing Gear.—The circuits are the same as for the S. II. mounting shown on Plate XII.

The Sights.—Telescopic on the left side only.

THE PEDESTAL MARK V. MOUNTING FOR TORPEDO BOAT DESTROYERS.

Plate XV.

The Pedestal is similar to that of the P. I. mounting. Bolted to the top is a steel training rack.

The Carriage is of forged steel and is similar to the carriage for the P. I. mounting, except that the elevating arc is attached to the right side of the Y bracket, the elevating gear being carried on the cradle.

The Elevating Gear is similar to that described for the P. VI. mounting. A body rest for the gunlayer, and the pistol grips, are fitted to sockets on the casing of the elevating gear, so that sights, body rest, elevating gear, and pistol grips all move together.

The Elevating Clamp.—A stop similar to that described for the P. I. mounting is fitted.

The Training Gear.—A training wheel (t_1) is fitted on the right of the mounting, a separate trainer being employed. The training rack and worm are completely enclosed in an oil-bath. The oil-bath is in two parts, the upper part (t_1) being bolted to the carriage and the lower part (t_2) to the upper part. The

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lower part bends up inside the training rack and is fitted with a cup leather which bears against the inside vertical surface of the training rack and prevents oil overflowing. The worm casing (t_5) is formed in the upper and lower castings of the oil-bath, and carries the filling, drain, and overflow holes. The training gear consists of a bronze worm feathered to a nearly horizontal shaft, at the rear end of which is the training wheel (t_6). The thrust of the training gear is taken up by ball-bearing rings. The training shaft is supported in bearings at the front and rear ends of the worm casing. At the front end an elongated slot allows the shaft slight motion in an horizontal plane. At the rear end the outer surface of the bearing is cylindrical in shape (t_7) and is free to rotate through a small angle horizontally. A cap (t_8) covers over a screw bolt.

Adjustment of Training Gear.—Remove cap (t_8) and by screwing in on the bolt underneath the training worm is forced in against the training rack, thus existing backlash can be removed, but care should be taken that the worm and worm-wheel are perfectly free to work without undue friction.

The Training Clamp.—The training gear is rigid, so none is fitted.

Training, Limit Stops.—A vertical arm (t_9) is carried on the carriage, and this taking against lugs on the pedestal limits the training.

The Cradle, Recoil Cylinder, and Spring Box combined are similar to those described for the P. I. mounting, with the following exceptions:—

The cradle completely encases the gun from trunnions to breech ring when the gun is run out.

The casting is extended under the recoil cylinder to form a bearing for the elevating shaft and carry the elevating gear.

Lubrication:—

Purpose.	No. of Holes.	Position.	Nature.
For lubricating:			
Cradle and gun	3	On cradle	Lubricator.
Trunnion bearings	2	On cap-squares	"
Elevating gear	4	On elevating gear bracket	"
Training gear	1	On training worm bracket	"
Bearings for rocking bar.	2	On sight bracket	"
Hand-wheel spindle	2	On range gear bracket cover.	"
Deflection gear	3	On deflection gear bracket	Oil screw.
Deflection pivot bolts	2	On pivot bolts	"
Deflection worm spindle.	3	On adjusting bush	Plain oil hole.

Attention is called to the fact that the oil-hole for lubricating the inner bearing of the elevating spindle is in a somewhat awkward position and is liable to be overlooked.

The Firing Gear.—The circuits are shown on Plate XV. diagrammatically.

Percussion firing gear similar to that described for the P. VI. mounting is now being fitted.

The Sights.—Dreyer, cross-connected with head rests for gunlayer and trainer. An open sight, in addition to the telescopic sights, is fitted on the left and a similar sight will be fitted on the right.

THE PEDESTAL MARK VI. MOUNTING FOR TORPEDO BOAT DESTROYERS.

(Plates XVI., XVII., XVIII., XIX., XX.)

The Pedestal is similar to that of the P. I. mounting. To the upper bush is secured the training rack, which is steel.

The Carriage is of forged steel and is similar to that for the P. I. mounting, with the following exceptions:—A 1-inch steel plate A is bolted to the right-hand side of the Y bracket, and projecting to the rear forms the elevating arc. The elevating gear is carried on the cradle. On the left side of the mounting a bracket is bolted to the cradle prolonging it to the rear. On this bracket pivots a swinging arm (l_1), pivoting about an axis (l_2), and carrying at its rear end another pivot, on which rests the loading tray (l_3). The loading tray is always kept parallel to the bore of the gun by means of two rods (l_4) secured to lugs on the lower end of the pivot in rear. At their front end these rods are secured to the bracket on the cradle. A spring catch (l_5), engaging in a notch on the swinging arm (l_1), holds the loading tray in the position clear of the recoil of the gun. To ensure the tray being right back in this position before the breech is closed, the B.M. lever is prolonged and has a roller on its end. This bearing against the tray forces it back as the breech is closed. The tray itself is telescopic and is locked in either its extended or closed position by means of a small spring clip.

The Elevating Gear (Plate XVII.).—The elevating gear is carried on a gunmetal casting B secured by four screw bolts to a bracket (c) on the under side of the recoil cylinder.

The elevating wheel (e_1) is feathered to the horizontal shaft (e_2) which carries a bevel wheel (e_3) at its other end. Bevel wheel (e_3) gears into another bevel wheel (e_4) on which a clutch is formed at AA. By means of this clutch bevel wheel (e_4) works rigidly with the worm (e_5), which has a similar clutch. Both (e_4) and (e_5) are carried on a horizontal shaft (e_6) on which they are free to revolve. Bearing washers for taking the thrust of the worm are provided at (e_7). The shaft (e_6) is screwed into

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the casting B at its front end, and is prevented from unscrewing by means of a collar (e_8) and set screw. The worm (e_9) engages in a worm wheel (e_9) which is connected to the horizontal shaft (e_{10}) by means of the friction washers of steel (e_{11}), which are feathered to shaft (e_{10}) and metal washers (e_{12}) which are feathered to the worm wheel (e_9).

The end of the shaft (e_{10}) is formed into a pinion which engages in the elevating arc.

The friction washers can be adjusted by means of the usual set nut (e_{13}), check nut (e_{14}), and spring washers (e_{15}) and split pin.

The elevating handle is pivoted eccentrically to the elevating wheel, and can be secured in any one of four positions. This is to suit the individual gunlayer.

The Elevating Clamp.—A spring stop can be put in an up or down position. When down, it takes between two spokes of the elevating wheel, and so holds the gun in elevation.

The Training Gear (Plate XVIII).—The training rack is of steel, and being lined with gunmetal forms the upper bush of the pedestal.

The gear is on the right of the mounting, a separate trainer being employed.

An oil bath, in two halves, is secured to the carriage.

The lower part of the oil bath, which carries a worm (t_2) and spindle (t_3), is bolted to the upper part, which, in its turn, is bolted to the carriage. The inner edge of the lower part of the bath is fitted with a cup leather C which bears on the inside vertical surface of the rack and prevents the oil overflowing. The worm casing is bolted to both upper and lower parts of the oil bath, and carries the filling, draining, and overflow screws.

The shaft (t_2) carries a training wheel (t_1).

The bearings for (t_2) are formed in metal bushes fitting into the steel sleeve (t_4). This sleeve is cut away to allow the worm (t_2) to engage in the training rack.

The sleeve has a spherical bearing (t_7) at its rear end which allows of a slight oscillatory movement. A bolt (t_8) and spiral spring (t) keep the sleeve and, consequently, the worm pressed towards the training rack at its front end.

The thrust of the worm is taken by ball-bearing rings (t_9).

Adjustment of the Training Gear.—By screwing in on the bolt (t_8) the worm may be made to gear closer into the training rack, thus taking up any backlash which may have developed, but care must be taken that the worm and worm wheel are free to move without undue friction.

The Training Clamp.—A steel band brake nearly surrounds the upper bush. In rear of the mounting this band is held in position by a vertical bolt B (Plate XVI). When the training clamp is set up the two ends of the band are drawn together and the upper bush is thus held to the pedestal.

Training Limit Stops.—A lug on the carriage bends over the worm bath and, taking against limit stops on the pedestal, limits the training.

The Cradle, Recoil Cylinder, and Spring Box combined are similar to those for the P. I. mountings, with the following exceptions:—The spring box entirely encloses the springs. A drain hole is fitted at the rear end. The casting is extended underneath the recoil cylinder to form a bearing for the elevating shaft and carry the elevating gear.

Lubrication :—

Purpose.	No. of Holes.	Position.	Nature.
For lubricating cradle and gun.	1	On top of cradle . . .	Lubricator.
Elevating gear . . .	5	Bracket carrying elevating gear.	Holes with oil screws.
Trunnion bearings . .	2	Trunnion caps . . .	" " "
Top bearing of pedestal	1	Left-hand side of carriage	" " "
Footstep bearing of pedestal.	1	Right-hand side of carriage.	Lubricatorcup.
Loading gear . . .	—	On gear . . .	Plain holes.
Sighting gear . . .	3	On the sights on the left,	Holes with oil screws.
	3	On the sights, two on left one on the right.	Holes with spring covers.
	3	" " " "	Plain oil holes.

The Firing Gear.—The percussion firing gear is shown on Plate XIX.

(a) is the sleeve extension on trigger, (b) is the spring plunger to prevent striker from turning. A casting (c) is secured to the bracket carrying the loading tray. This casting carries a vertical spindle (d) which supports a bell crank (e). One arm of bell crank takes against a bevelled block (f) on the sleeve (a), and the other arm is secured between a collar and a nut on an adjustable horizontal rod (h). This rod has an adjusting sleeve (j) and is supported by a bracket (k) on the inside of the shield. A spring is placed between the collar (g) and the arm of the bell crank, and this spring keeps the bell crank bearing against the rear nut. The pull-off can be adjusted by means of the sleeve (j), the final adjustment being obtained by means of the rear nut (i).

To the front end of the horizontal shaft (h) is secured one arm of a bell crank (e). The other arm of (l) is secured to a vertical rod (m) attached to the trigger (n). The trigger consists of a bell crank lever in a case.

A spring (p) between a collar on the bracket (k) and nut (q) on the shaft returns the rod (h) to the rear when trigger is released.

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Action of the Mechanism.—On pressing the trigger (*n*) rod (*m*) is pulled down, and by means of bell crank (*e*) rod (*h*) is pulled to the rear. Bell crank (*e*) is rotated and sleeve (*a*) is pulled to the left. This releases the trigger and so striker flies forward. Spring (*p*) returns the gear to its normal position after firing.

Should the percussion gear fail a loop (*s*) is fitted at the end of the trigger sleeve. A lanyard can be hooked to this loop on the sleeve and the gun fired by lanyard.

To shift to Electrical Firing.—Either unship striker and ship one not specially fitted for percussion firing, or else unship striker, disconnect sleeve (*a*), remove spring case and trigger spring. Replace spring case and insert pin holding sleeve, trigger, and case together. Then connect up circuits. Spring plunger (*b*) must be withdrawn in order to turn the striker.

Electrical Firing.—A diagram of the circuits is shown on Plate XVI. Details of the circuit at the breech on Plate XX. In this mounting the run-out contact is separated, the main contact being on the left and the auxiliary on the right of the mounting.

The Sights are telescopic and cross-connected, with open sights for both layer and trainer in addition.

CHAPTER III.

ORDNANCE Q.F. 12-PR. 18-CWT., MARK I.

Plate II.

The gun is made of steel and consists of A tube (A), B tube (B), breech piece (P), breech bush (C), a series of layers of steel wire (W), jacket (J), and breech ring (R). The A tube extends throughout the bore. Over a portion of the A tube is shrunk the breech piece, secured longitudinally by corresponding shoulders, and a breech bush which is screwed into the breech piece at the rear; the bush is also prepared for the reception of the breech screw. The B tube is shrunk over the front portion of the A tube from the muzzle and partially overlaps the breech piece. Over the breech piece are wound successive layers of steel wire, the ends of which are secured to steel rings.

The jacket is fitted over the exterior of the wire and a portion of the B tube, and is secured longitudinally by corresponding shoulders on the latter, and by the breech ring which is shrunk over the rear end of the breech piece and screwed to the jacket.

Fixing screws prevent breech bush and breech ring from turning.

Lugs are formed on the breech ring at the rear for the attachment of the breech mechanism of the gun, and on the

underside for connecting the gun to the recoil piston rod and to the running-out springs of the mounting.

The exterior of the jacket has a feather above and below to prevent the gun from turning in the cradle.

The chamber is slightly coned to facilitate the extraction of the empty cylinder.

PARTICULARS OF THE GUN.

Material	-	-	Steel, wire construction.
Length	-	-	154.7 inches.
Weight with fittings	-	-	18 cwt. 2 qrs. 6 lbs.
Bore	calibre	-	3 inches.
	length	-	150 inches = 50 calibres.
Chamber	length	-	20.6.
	diameter	-	4 inches to 3.24 inches.
Capacity	-	-	186 cubic inches.
Rifling	system	-	Polygroove, modified plain section.
	length	-	128.162 inches.
	twist	-	1 in 30 calibres.
	grooves	-	20, .314-inch \times 0.4-inch.

CHAPTER IV.

MOUNTINGS FOR THE 12-PR. 18-CWT. GUNS.

The Pedestal Mark IV. Mounting.

Plates XXI. and XXII.

These guns are mounted only in some light cruisers, from which they will be removed.

The Pedestal is similar in construction to that described for the P. I. mounting. The training rack is secured to the upper metal bush.

The Carriage is similar to that described for the P. I. mounting, except that at the left side it is prolonged to the rear to take the elevating gear and shoulder piece.

The Elevating Gear is similar to that described for the P. I. mounting. There are, however, five bronze and six steel washers.

The Elevating Clamp. None fitted.

The Training Gear.—Training gear has now been fitted to all P. IV. mountings. The gear is on the right of the mounting, a separate trainer being employed. The training rack is secured to the upper bush and is made rigid with the pedestal by means of a band brake. The mechanism is similar to that described for the P. II. mounting. The training wheel and shaft are supported by a bracket on the carriage and the worm is split.

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Adjustment of the Training Gear.—By screwing up on the bushes of the training worm the two halves of the split worm are forced together, and thus any backlash can be eliminated.

The Training Clamp.—This consists of a complete steel band, having a threaded bolt riveted to it which projects outwards. This bolt passes through a hole in the rear of the pedestal and on it is screwed the clamping nut. On setting up on the clamping nut the face of the nut bears against the pedestal and the screwed bolt is pulled outwards; thus the band brake grips the upper metal bush and so connects it to the pedestal. On the opposite of the pedestal to the threaded bolt is a second hole, through which passes a second screwed bolt. This bolt is secured to the pedestal by two nuts and it keeps the band up in place.

Training Limit Stops (Plate XXII).—A vertical bolt B taking against the buffers C limits the training. Inside C are two spring washers to absorb shock, B can be lifted clear of C if required to increase the angle of training.

The Cradle, Recoil Cylinder, and Spring Box combined are similar to those of the P. I. mounting. Cylinder drain screw is in same position as in the P. III.

Lubrication:—

Purpose.	No. of Holes.	Position.	Nature.
For lubricating:—			
Gun and cradle -	1	On the top of the cradle -	Lubricator.
Trunnion bearings -	2	On capsquares -	Oil screws.
Footstep bearing of pedestal.	1	On top of pedestal in front	Oil screw.
Elevating hand wheel shaft.	1	On elevating gear bracket	" "
Elevating worm wheel	1	" " " "	" "
Elevating worm wheel shaft.	1	" " " "	" "
Training worm -	1	On training worm bracket	" "
Deflection gear of sight	2	On deflection gear bracket	Oil holes.
Sight elevating gear -	1	On sight 'tween range dial and telescope holder.	" "
Range hand wheel spindle.	2	On range gear bracket -	" "

The Firing Gear.—The diagram of the circuits on Plate XXI. shows these guns fitted for battery firing.

The Sights.—Telescopic cross-connected.

THE PEDESTAL MARK IV.* MOUNTING MOUNTED IN BATTLESHIPS AND CRUISERS.

Plates XXIII. and XXIV.

The Pedestal.—Similar to that of P. IV. mounting, but is of a slightly different shape.

The Carriage is the same as the P. IV. carriage.

The Elevating Gear is the same as that of the P. IV.

The Elevating Clamp.—None fitted.

The Training Gear (Plate XXIV.).—The gear is on the right of the mounting, a separate trainer being used.

A vertical shaft carries a training wheel (T_1) at its upper end and a bevel wheel (T_2) at its lower end. (T_2) gears with another bevel wheel (T_3) carried on the end of a horizontal shaft (T_4), which carries a worm (T_5), at its other end. (T_5) gears into the training rack. A casing (T_6) supporting the worm (T_5) is bolted to the carriage. The thrust of the worm is taken by ball bearings.

An adjustable shoulder rest (T_8) for the trainer is carried on a bracket on the carriage.

Adjustment of the Training Gear.—Play between the worm and rack can be taken out in the same manner as described for the S. II. mounting.

The Training Clamp (T_9) consists of a bolt bearing against two spring washers which bear against a metal block. This bears against the upper bush.

Training Limit Stops are the same as those of the P. IV. mounting.

The Cradle, Recoil Cylinder, and Spring Box are the same as for the P. IV., except that the spring box instead of being formed in the casting of the cradle is a separate steel cylinder secured to the cradle by two brackets. This facilitates unshipping the run-out springs, where the position of the mounting does not allow of the springs being removed out of their box to the front.

Lubrication:—

Purpose.	No. of Holes.	Position.	Nature.
For lubricating:—			
Gun and cradle	1	On top of cradle	Lubricator.
Trunnion bearings	2	On capsquares	Oil screws.
Footstep bearings of pedestal.	1	On top of training rack	Oil screw.
Bevel wheels of training gear.	1	Training gear bracket	" "
Training worm	1	On cover for worm	Lubricator.
Elevating handwheel shaft.	1	Elevating gear bracket	Oil screw.

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Purpose.	No. of Holes.	Position.	Nature.
Elevating worm wheel	1	Elevating gear bracket -	Oil screw.
Elevating worm wheel shaft.	1	" " " "	" "
Deflection gear of sight	3	On sight bracket between deflection dial and telescope holder.	Oil holes.
Range pinion	1	On sight bracket between range dial and telescope holder.	Oil hole.
Range hand wheel spindle.	2	On range gear bracket -	Oil holes.
Range cross-connection gear.	3	Two on the right and one on the left on metal bushes securing the gear.	" "

The Firing Gear.—Diagram of circuits is shown on Plate XXIII.

The Sights.—Telescopic cross-connected slightly different to P. IV.

ALL 12-PR. 12-OWT. AND 18-OWT. MOUNTINGS.

TO ASSEMBLE THE RECOIL CYLINDER.

1. Screw in controlling plunger; take care to see that the flat surface cut on it is towards the bottom of the cylinder.
2. Place valve key and secure it with its fixing bolt and leather washer.
3. Insert piston. Insert L-leather into cylinder plug, screw in inner gland, place leather joint washer, and screw plug into cylinder.
4. Place cotton-packing, screw in outer gland.
5. Run screw nut on to piston rod, see gun run out, screw securing nuts on to end of piston, and place keep pin.

TO ASSEMBLE THE SPRING BOX.

1. Place inner spring on flange of compressor, place distance piece on compressor, place outer spring on distance piece.
2. Reeve bolt compressing through spring plate and screw it into compressor as far as it will go, thus putting the necessary compression on the springs. Place springs and compressor in spring box.

P. I., P. V.,
P. VI., P. IV.

3. Reeve running-out rods through crosshead cradle and horn on gun, see feathers on rods gear into featherways on crosshead.
4. Secure rods with spring forelocks, screw nuts and pins.

- †P. III. { 3. Secure R.O. rods into crosshead, then reeve
and { them through horn on gun.
S. II. { 4. Secure rods with screw nuts and pins.
†P. IV. { 3. Secure the spring box to cradle, and then
{ proceed as for P. I.

TO SHIFT A SPRING.

First secure the gun from running back, then remove springs bodily from spring box and replace with spare springs which are kept on a compressor ready to be shipped into place without the labour of screwing them up.

The springs of the P. I., P. V., P. VI., and P. IV. come out before all. Those of the †P. IV.* can come out before all, or the spring box can be removed bodily. The springs of the P. III. and S. II. fall down in rear.

DISMOUNTING GEAR.

Dismounting gear is supplied to all 12-pr. mountings. It consists usually of a special davit, the heel of which fits into a shoe. This shoe is secured by screw bolts to a bottom plate on which it rests, and to the pedestal of the mounting. The bottom plate (steel) is bolted to the deck. In other cases a suitable bolt is secured to a beam over the gun. A hyperacmé block and purchase are supplied for use with the davit or bolt. 12-cwt. and 18-cwt. guns are lifted in their cradles with a special lifting bolt except the P. V. mounting. 8-cwt. guns must be slung with a wide strap.

NOMINAL WEIGHTS.

—	P. [*]	P. I.	P. III.	S. II.	P. V.	P. VI.	P. IV.	*P. IV.
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
Cradle	6½	5	4	4½	7	11	6½	7½
Carriage	5	5	3	4	7	5½	5	6½
Pedestal	3½	3½	4½	—	4½	6½	4½	5½

Where 12-pr. guns are used for saluting, care is to be taken that they are occasionally shifted, so that the same guns are not always used for the purpose. Cases have occurred in which the erosion due to saluting charges has necessitated the condemnation of the gun.

Where training gear is fitted it is necessary to work the gear daily to ensure a flow of oil.

Where the gear is frictional the clamp must be eased up and the rack moved round periodically to ensure that wear does not come on one part of the rack only.

† The R.O. rod of these mountings cannot come unscrewed, because a nut (part of the rod) holds them before the horn, and another nut screws on in rear of the horn.

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CHAPTER V.

ORDNANCE Q.F. 12-PR. 8-CWT. MARK I.

Plate 1.

The gun is of steel and consists of an "A" tube, over which is shrunk a jacket, prolonged at the rear for the reception of the breech screw, and a "B" tube extending to the muzzle. A "C" hoop is shrunk over portions of the jacket and "B" tube, securing them longitudinally by means of shoulders on the "B" tube and a screw thread on the jacket.

The jacket is provided with two trunnions, and on its right-hand side is a projection in the form of a bracket, to which is secured by means of a hinge bolt, the carrier.

PARTICULARS OF THE GUN.

Nominal weight	-	-	-	-	-	8 cwt.
Length, total	-	-	-	-	-	87.6 inches.
Bore	{	diameter	-	-	-	3.0 inches.
		length	-	-	-	84.0 inches.
		capacity, including chamber and grooves	-	-	-	617 cubic inches.
Chamber	{	diameter	{	rear end	-	3.6 inches.
			{	front end	-	3.392 inches.
	{	length	-	-	-	8.045 inches.
		mean capacity of cartridge case	-	-	-	59 cubic inches.
Rifling	{	number of grooves	-	-	-	16
		depth of grooves	-	-	-	.04 inch
		width of grooves	-	-	-	4 inch.
		total length	-	-	-	74.81 inches.
		width of lands	-	-	-	.189 inch.

The rifling is E.O.C. polygroove; the twist is from 1 in 60 calibres at the breech to 1 in 28 calibres at the muzzle, uniformly increasing.

In the later guns it is straight for the first 18 inches and then uniformly increasing to 1 turn in 30 calibres at the muzzle, and of R.G.F. section.

The 12-pr. 8-cwt. Mark I. gun is intended to be mounted on either a field or a boat mounting, as required. When not in use for these purposes, a holding-down ring is provided in a fighting position on board the ship, in which is shipped the boat mounting and 8-cwt. gun.

CHAPTER VI.

MOUNTINGS FOR THE 12-PR. 8-CWT. GUN.

THE GENERAL SERVICE MARK I. MOUNTING FOR
BATTLESHIPS, CRUISERS, AND LIGHT CRUISERS.

Plates XXV. and XXVI.

This mounting was designed for use with the 12-pr. 8-cwt. gun mounted in a 42 ft. pulling launch.

The launches are fitted so that a 3-pr. Hotchkiss gun may be mounted instead if required.

When not away in a boat the mounting is supplied with a fighting position on board, the pivot plate fitting in a general service holding-down ring.

The **Mounting** consists of a carriage (c_1), with recoil cylinder and bearings for the gun trunnions; a slide (s_1) with elevating arc, shoulder piece, and pistol; a revolving bracket (b_1) with training clamp (b_2), clip-ring (b_3), and bearings for the slide trunnions; a pivot plate (b_4) and a thick shield (b_5).

The revolving bracket is a Y-shaped steel forging, with bronze bearings for the trunnions of the slide, which are secured by cap squares (c_2) and securing pins.

The base of the bracket is cylindrical with a screwed bolt in the centre for taking the weight off the revolving bracket. This screwed bolt is similar to that described for the S. II. mounting and is adjusted in a similar manner.

The pivot plate (b_4) is a hollow steel forging closed on the top which supports the moving parts of the mounting. A circular recess in the upper surface receives the pivot on the bottom of the revolving bracket. The lower part is shaped to fit the Service holding-down ring.

The clip-ring (b_3) is a bronze flanged ring in two halves, secured together by two bolts (b_6). It holds the pivot plate and the revolving bracket together whilst permitting the latter to rotate in training.

The carriage is a casting of high strength brass supporting the gun; it is capable of movement backwards and forwards on the slide; but any vertical play is prevented by a long clip on each side of the slide; it is fitted with trunnion bearings for supporting the gun, which is secured by cap-squares with pins securing.

The slide is a casting of high strength brass which supports the gun and carriage. It has surfaced faces to allow the carriage to slide along on recoil.

The gun rests in the trunnion bearings of the inner carriage or slide and on a removeable metal block at the front of the inner carriage. When a gun is moved from one mounting to

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another it may be necessary either to change the block or to file a little off the block to ensure the gun being a good fit.

The Elevating Gear.—By shoulder piece on the left of the mounting. Limits, 20° elevation, 10° depression.

The Elevating Clamp.—An elevating clamp E of the usual type is fitted. When firing, the clamp should be set up moderately taut to take the weight of the gun on recoil. The elevating arc is secured to the slide.

Training.—By shoulder piece.

Adjustment of Training Gear.—The pivot bolt must be adjusted similarly to the S. II. mounting (*see* page 24). The training clamp is set up to the required tautness.

The Training Clamp.—A training clamp of the usual type is fitted at (b_2).

The Recoil Cylinder and Springs.—That portion of the casting immediately under the gun forms the recoil cylinder. This cylinder allows of a recoil of 12 inches and is fitted with a valve key (c_{10}) secured in place by a bolt (c_{11}). In order to disconnect the piston rod a steel cap (c_2) is screwed to the rear end of the cylinder, so that by unscrewing the nuts on the front end of the rod, it can be drawn out from the rear of the cylinder.

On either side of, and just above the recoil cylinder, and riveted to the carriage, are two steel running-out spring cases (c_3). The piston rod (c_4) of the recoil cylinder and the two bolts compressing springs (c_{14}) are attached to the front end of the slide.

The recoil cylinder is closed at the rear end by a steel cover (c_5) with a leather washer, at the bottom of the cylinder, and attached to it by a bolt with a leather washer is a valve key (c_{10}), which is rectangular in section. A piston rod (c_6) with a port cut in it through which the key works, has screwed into it two nuts; the nut in rear (c_7) merely acts as a collar to work in conjunction with the front nut to keep the piston rod fast, the front nut (c_8) takes the whole strain of recoil. It is kept from unscrewing by a pin. The piston rod is prolonged to the rear through the piston head. This prolongation enters into a recess in the cylinder closing cap (c_5) as the gun approaches the "out" position, so bringing the gun quietly to rest. The diameter of the prolongation is slightly larger than the diameter of the piston rod proper. The prolongation and cap are also coned so that their action may be one of gradual cut-off.

The joint between the piston rod and the recoil cylinder is made by means of cotton packing and a gland (c_9). The cylinder is also fitted with air, filling, and drain holes (c_{12}), each with a plug and a leather washer.

The springs are almost identical with those for the S. II. mounting, only differing in detail though the two sets are not interchangeable. The correct amount of compression is put on the springs (c_{13}) by screwing the compressor (c_{16}) hard up. This is done by means of a special spanner which fits into two slots cut in the rear face of the compressor. The compressor bolt (c_{14}) has a nut screwed into it, which holds the end plate (c_{17}) in position, and is prolonged to the front for securing to the fore end of slide. A steel bush (s_2) is screwed into the front cross-piece (s_1), and through this bush is passed the compressor bolt, which, being threaded at the end, is then secured by a nut (c_{18}) and split pin.

NOTE.—Since there is no tank for keeping the recoil cylinder full of liquid, great care must be taken to see the glands efficient, and not more than 20 rounds are to be fired from this mounting without refilling the recoil cylinders.

Lubrication:—

Purpose.	No. of Hole.	Position.	Nature.
For lubricating:—			
Trunnions	2	On capsquares	Oil screws.
Slide of inner carriage	4	On inner carriage	
Pivot bearing	1	Pivot bolt	Oil hole with plug.

The Firing Gear.—Current is led straight from the battery to the pistol grip and thence to striker.

Battery is not shown in the plates. It would be under the fighting thwart of the launch.

No night sight illuminating gear is fitted. When mounted on the field carriage, percussion firing only is used. A combined spanner and cocking piece is supplied for the striker instead of the elbow piece.

The Sights.—Guns on the G. I. mounting and field mounting have a tangent sight and foresight. When mounted on the top of a turret, the gun is laid from the position in the turret.

THE G. I.* MOUNTING FOR DESTROYERS OF THE RIVER CLASS.

Plates XXVII, XXVIII, XXIX.

A number of G. I. mountings have been converted into G. I.* mountings and mounted in destroyers.

The Carriage.—The same as G. I., except that a preponderance weight is fitted in front of the shield to balance the alterations in the mounting.

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Elevating Gear.—By shoulder piece, but the shape of the shoulder piece has been modified to suit the new position of the sights.

Elevating Clamp (Plate XXIX).—An automatic clamp has been fitted. The elevating clamping arc (c_1) is secured to the revolving bracket. Attached to the right spring box is the rod (c_2), the rear end of which is connected to the crank (c_3). This crank works on the elevating clamping bolt (c_4) and has a bevelled shoulder on its boss (c_5). Fitting on the squared part of the elevating clamping bolt (c_4) is a washer (c_7), which also has bevelled shoulders. When the gun is run out the bevelled shoulders on (c_7) fit into the recesses on the boss of the crank (c_5). Between (c_7) and the clamping arc (c_1) are two spring washers and a metal washer.

Action of the mechanism.—The clamping handle (c_6) should be set up moderately taut, but so that free elevation is obtained. On the gun recoiling the rod (c_2) comes to the rear turning the crank (c_3). The bevelled shoulders (c_5) on the crank ride over the bevelled shoulders on the washer (c_7), and as the crank cannot move outwards, because it is hard up against the clamping handle (c_6), the washer (c_7) is forced inwards towards the gun, compressing the spring washers against the clamping arc (c_1) and holding the gun in elevation.

Training - - - - -

Adjustment of Training Gear - - - - -

Training Clamp - - - - -

} The same as for the G. I. mounting.

Recoil and Run-out Arrangements and method of stripping and assembling recoil cylinder and run-out springs are identical with the G. I. mounting.

Lubrication:—

Purpose.	No. of Holes.	Position.	Nature.
For lubricating:—			
Trunnion bearings -	2	On capsquares - - -	Oil screws.
Slide of inner carriage -	4	On inner carriage - - -	"
Pivot bearing - - -	1	Pivot bolt - - - - -	Oil hole with plug.

The Firing Gear.—Circuits. The leads of wires are very clearly shown on Plate XXVII. Only one battery is fitted. A spare firing circuit is supplied, and this must be connected up to the main battery when required.

The Sights.—Telescopic. The sight bracket is secured to the slide in front by a bolt screwed into the left trunnion and in rear by two screws.

To dismount the slide the sight bracket must first be removed before the trunnion capsquares can be removed.

Safety Depression Gear.—The after 12-pr. mounting of the River class destroyers is fitted with safety depression gear consisting of a spur 18 inches long secured to the lower part of the front protecting shield of the mounting. The lower end of the bracket carries a roller which bears on a cam rail, secured between the holding-down ring and the pedestal. The contour of the cam rail is made to suit each particular vessel.

G. I. AND G. II[®] MOUNTINGS.

TO ASSEMBLE THE RECOIL CYLINDER.

1. Place in valve key and secure it with bolt securing; screw in drain plug.
2. Enter piston and rod, and, before receiving latter through fore end of slide, place packing round rod and screw in gland, then screw on rear securing nut (c_7) and see it screwed hard up.
3. Reeve piston rod through front end of slide and secure it in front by nut (c_8) and split pin.
4. Screw on cylinder closing cap.

NOTE.—Leather washers are supplied for all plugs and cylinder closing cap.

INSTRUCTIONS FOR FILLING RECOIL CYLINDER.

The gun should be given extreme elevation and the drain plugs and both filling plugs removed.

Liquid should then be poured in through the latter until it begins to overflow at the former, which must then be replaced, and the filling must proceed at one filling hole only until the liquid overflows at the opposite one; the filling plugs must then be replaced. In the event of requiring to replenish the cylinders which have been already filled, the same method is to be employed, as accidents have occurred through the choking of the filling channels because, on the removal of the filling plugs the cylinder appears to be full of liquid, whereas it might be empty or partially so.

Quantity of liquid required one quart.

ACTION OF RECOIL CYLINDER.

On the gun being fired the gun recoils carrying with it the carriage, hydraulic cylinder, and valve key; the piston rod, being secured to the slide, remains stationary. The valve key varies in shape on the top edge so that although the liquid will pass freely through the port at the commencement of recoil, the port is gradually closed towards the end—the form of the key is in fact such that the velocity of the liquid through the port is approximately uniform during the whole of the recoil; by this means a uniform pressure is obtained in the cylinder.

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ACTION OF RUNNING-OUT SPRINGS.

On the gun being fired, the gun carriage and spring cases recoil to the rear, compressing the running-out springs between the foremost end of the spring cases and the compressor. On the completion of recoil the springs assert themselves and run the gun out till the stops on the carriage take up against the fore part of the slide, the gun being quietly brought to rest by means of the cushioning action of the piston head in the cylinder closing cap.

CHAPTER VII.

CARRIAGES AND LIMBERS FOR 12-PR. 12-, 18-, AND
8-CWT. GUNS.IMPROVISED FIELD MOUNTING FOR 12-PR. 12-CWT.
GUN.

Plate XXX.

Several of these mountings were used by the Naval Brigade in the South African War.

Trail.—Baulk of timber, preferably oak, 10·5 inches by 10·5 inches by 10 feet with cheek pieces 10·5 inches by 12 inches by 3 feet, riveted together by four $\frac{3}{4}$ -inch through bolts 36 inches long.

Filling pieces oak, 8 inches by 8 inches by $2\frac{1}{4}$ inches.

Heel plate round end of trail $\frac{1}{4}$ -inch.

Handles $\frac{1}{4}$ -inch bar riveted by two $\frac{1}{2}$ -inch bolts, $12\frac{1}{2}$ inches long.

Saddle.—To take push of struts, $\frac{1}{4}$ -inch plate.

Struts $\frac{1}{2}$ -inch plate bolted to saddle and trail with two 1-inch through bolts 14 inches long and secured to mounting by two 1-inch screwed bolts, 2 inches long.

Top plate, straight, $\frac{1}{4}$ -inch plate with 6-inch hole bolted to bottom plate $\frac{3}{4}$ -inch with four $\frac{1}{4}$ -inch bolts, 16 inches long.

Kicking Plate.—(Under base plate of mounting) $\frac{1}{4}$ -inch let in.

Dragshoes.— $\frac{1}{4}$ -inch with ropes of 2-inch wire.

Wheels.—Not less than 42 inches track and about 42 inches diameter.

Axletree.—Similar to that of field mounting for the 12-pr. 8-cwt. gun.

Weight of Gun and Carriage about 25 cwt.

Limber.—An ordinary waggon was used as a limber for long transport, the intention being to lift the gun out of its trunnions and put it into the waggon.

NAVAL TRAVELLING CARRIAGE AND LIMBER
FOR 12-PR. 18-CWT. MARK I. GUN.

Plate XXXI.

This carriage does not possess any great mobility, but is somewhat on the lines of the extempore carriages used for the 12-pr. 12-cwt. guns during the South African War.

The carriage was originally so arranged that the gun together with its cradle, elevating arc, and telescopic sights could be transferred from the P Mark IV.* mounting to the

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landing carriage. In this case no sight on the right was required, so the right sight and cross connections had to be unshipped first. Special cradles with a single sight have now been provided for the carriages.

In order to suppress jump it has been found necessary to make the trail abnormally long. The bottom of the rear end of the trail A is shaped so as to act as a spade, and when this is firmly embedded in the ground the length of trail combines to give a steady carriage when firing horizontally.

The general construction of the carriage is similar to that described for the 12-pr. 8-cwt. gun with the following exceptions:—

- (1) The elevating gear is similar to the P. IV.
- (2) The carriage trail can be moved laterally on the axletree giving a traversing movement four degrees each way, by means of a traversing screw actuated by a hand-wheel B on the left of the trail, the rear end of the trail forming the pivot for the training movement.
- (3) A brake C is fitted instead of drag shoes.

The wheels are 56 inches in diameter.

The limber consists of a stamped steel frame and the limber boxes are of steel. In other respects it is similar to that of the 12-pr. 8-cwt.

Each box carries 32 projectiles and 32 cartridges, and fuzes and small stores.

Experiments have shown that on soft ground the carriage recoils about 5 inches, whilst on a Macadam road the carriage recoiled 4 feet.

For ascending a moderate incline a crew of 50 men is required, whilst along a level road a crew of 36 men is sufficient.

NOMINAL WEIGHTS.

	Cwts.	Qrs.	Lbs.
Gun	18	0	0
Cradle with recoil cylinder and R.O. springs	5	3	20
Carriage complete without stores	11	0	0
Wheels	4	0	26
Lights	2	2	21

CARRIAGE AND LIMBER FOR 12-PR. 8-CWT.

MARK I. GUN.

Plates XXXII. and XXXIII.

The Carriage is constructed principally of steel, and is arranged to allow of from 15 degrees elevation to 8 degrees depression being given to the gun.

It consists of two bracket sides A, an axletree B, and two field wheels.

The bracket sides are of steel plate, strengthened by steel angle and transoms. They are fitted with trunnion bearings C and cap-squares D, and a trail eye E.

The axletree B is a hollow steel forging, and is made removable, it is secured in bearings in the bracket sides by means of a nut screwed on the axle, the nut is in turn prevented from unscrewing by a small set bolt.

The wheels are 42 inches diameter, Madras pattern, with steel tyres and gun-metal naves F. The elevating gear consists of a worm wheel with friction cone, which transmits motion from a spindle G with handle H to a pinion which gears into the arc J on the gun.

The arc is hinged at K to prevent it being injured should it strike an obstacle whilst travelling. For reducing the recoil during firing the carriage is furnished with drag shoes L which are attached to the trail by wire rope M. The trail should never be buried.

The limber is constructed of steel. The body consists of an angle frame N, with socket O for the centre-pole Q and side flanges R for the axletree.

The axletree S is a weldless steel tube forged at the ends into arms. It is turned throughout so that it can be readily removed if damaged.

The wheels are of the same description as those for the carriage.

The limber hook T is of steel and is riveted to the rear of the body of the limber.

The limber is fitted with a centre pole Q with 2 slats W for man haulage.

The ammunition boxes are of wood, steel bound, and are secured to the limber body by nib irons and screws.

Each box is fitted internally to carry 12 projectiles, 12 cartridges, fuzes, and several small stores. The projectiles and cartridges are carried vertically, and are steadied by wood blocks fixed to the lid of the box and recessed to fit over the heads of the shells.

NOMINAL WEIGHTS.

	Cwts.
Carriage - - - - -	6½
Limbers - - - - -	6½
Gun, carriage, and limber equipped	27

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CHAPTER VIII.

STORES TO BE PACKED ON FIELD CARRIAGE AND
LIMBER OF 12-PR. 18-OWT. GUN.

FROM N.O. DEPÔT.

Spare parts of guns :

Bush sliding block - - - - -	1
Springs, extractor - - - - -	1
Springs, catch retaining breech screw, open - - - - -	1
Stop, safety - - - - -	1
Striker - - - - -	1

Appurtenances :—

Cans, Lubricating, No. 10 - - - - -	1
Drift - - - - -	1
Punch - - - - -	1
Wrenches Nos. 79, 71, 67 Mark I. - - - - -	1 of each.
Extractors, hand, small - - - - -	1
Axes, hand, 2 lbs. - - - - -	1
Axes, pick, 5 lbs., helved - - - - -	1
Hooks, bill - - - - -	1
Spades - - - - -	1
Buckets, water - - - - -	1
Cleaners, piassaba, and wool - - - - -	1 of each.
Lanyards, No. 9 - - - - -	2
Harness, men, naval set - - - - -	1
Match, slow - - - - -	2 lbs.
Key setting fuze, No. 14 - - - - -	2
Key, base fuze, and plug - - - - -	1
Tubes, percussion - - - - -	4 boxes; 40.

FROM DOCKYARD.

File, flat bastard, 8-inch - - - - -	1
Hammer, claw, steeled - - - - -	1
Pins, keep, split :—	
1·7 inch by 0·148 inch - - - - -	2
1·5 inch by 0·148 inch - - - - -	2
1·0 inch by 0·128 inch - - - - -	7
Spanner, McMahon, 8-inch - - - - -	1

12-PR. 8-CWT. GUN.

LIST OF STORES TO BE TAKEN AWAY WITH THE
FIELD MOUNTING, SHOWING STOWAGE.

Article.	No.	Where stowed.
Handspikes, traversing -	2	} On carriage trail.
Hammer, claw, steeled -	1	
Extractor, cartridge, hand -	1	
Rimer, vent, axial, short -	1	} Upper tray in trail box.
Key, fuze, universal -	1	
Driver, screw -	1	
Wrench, No. 79 -	1	
Wrench, E., No. 71 -	1	} Lower tray in trail box.
Punch, No. 11 -	1	
Drift, No. 7 -	1	
Can, lubricating, No. 11 -	1	
Spanner, MacMahon, 8-inch -	1	} On inside of left lid, in leather pockets.
Spanner, elevating gear -	1	
File, flat, bastard 8-inch -	1	
Pin, linch -	1	
Sight, tangent, with clamp - (spare)	1	} Under platform in left limber box.
Sight, fore - (spare)	1	
Key, fuze, universal -	1	
Portfires, common -	4	
Slow match - lbs.	2	} In space R.
Pocket tube -	1	
Bandoliers electric tubes, No. 1 -	1	
Tubes, percussion (3 boxes) -	30	
Lanyard, No. 9 -	1	} In space S.
Washer, drag, for limber -	1	
Cleaner, plasaba, with lanyard -	1	
Cleaner, wool, with lanyard -	1	
Lanyard, No. 9 -	1	} On inside of right lid, in leather pockets. Stores marked * are together in a small box, the box being in a leather pocket.
Sight, tangent, with clamp, when not in gun. -	1	
Sight, fore, when not in gun -	1	
Striker, electric and percussion, complete. -	1	
Stop, safety -	1	} Under platform in right limber box.
Pin, keep, bolt, elevating -	1	
*Trigger, complete -	1	
*Bush, sliding block -	1	
*Spring catch, retaining breech screw, open. -	1	} Contents of ammunition boxes.
*Screw, preserving, fore sight -	1	
*Pins, keep, split, 17" x .148" -	2	
*Pins, keep, split, 15" x .148" -	2	
*Pins, keep, split, 1" x .128" -	4	} In spaces Q.
Washer, drag for gun -	1	
Shells, common -	12	} Contents of ammunition boxes.
Shells, shrapnel -	12	
Cartridges, Q.F., 12-pr. -	24	} In spaces Q.
Fuzes, time and percussion, Mark IV. (in 4 cylinders). -	12	

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Article.	No.	Where stowed.
Ropes, drag, light	- pairs	1
Swingletree	-	1
Spade, N.P.	-	1
Axe, hand, 2 lbs.	-	1
Hook, bill	-	1
Axe, pick, 5-lb., helved	-	1
Buckets, water, G.S.	-	2
Slate	-	2
Box, grease	-	1
Harness, man, naval	- sets	1†
		No stowage required.

† Consisting of:—16 loops, webbing.
1 shoulder-strap, webbing.
2 drag ropes (with loops and chains attached).

PR, 12 AND 8 CWT.

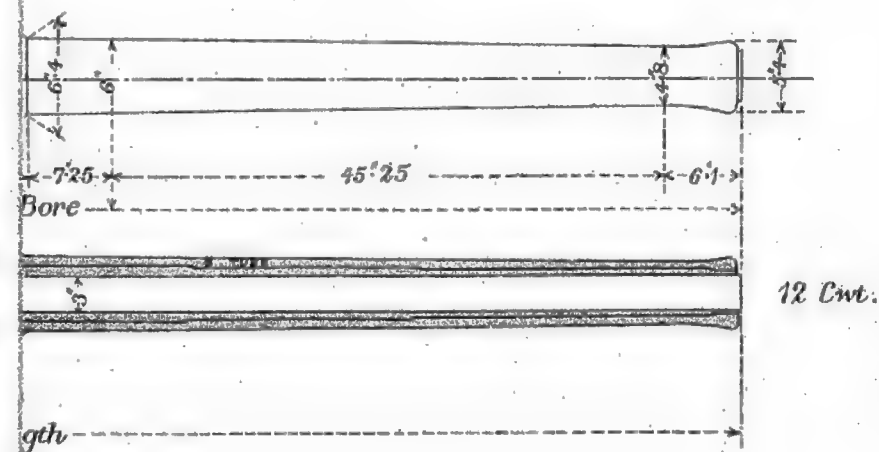
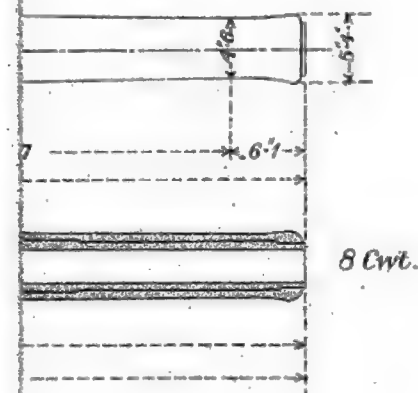
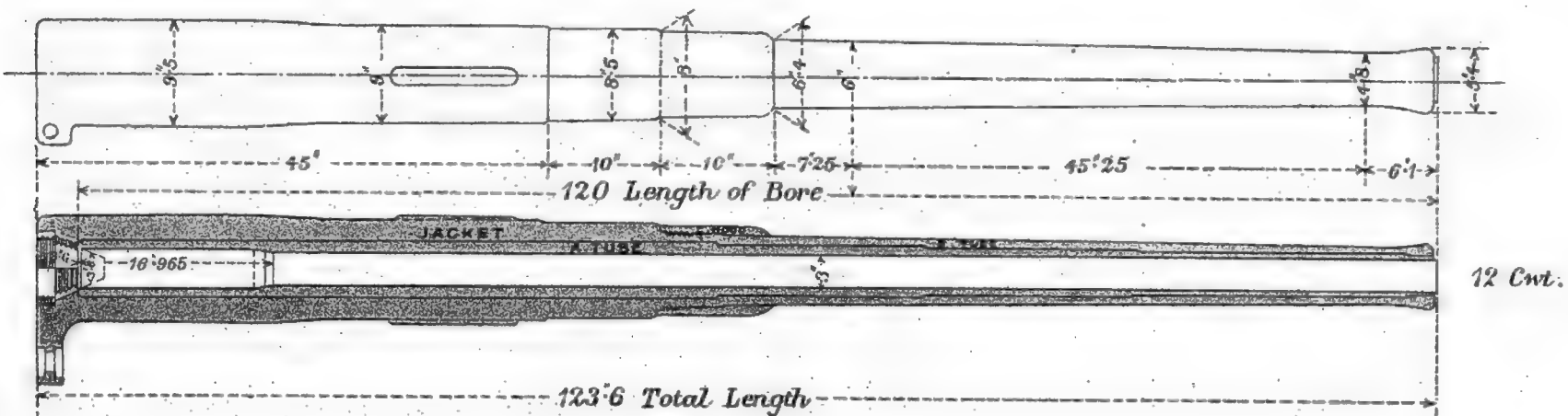
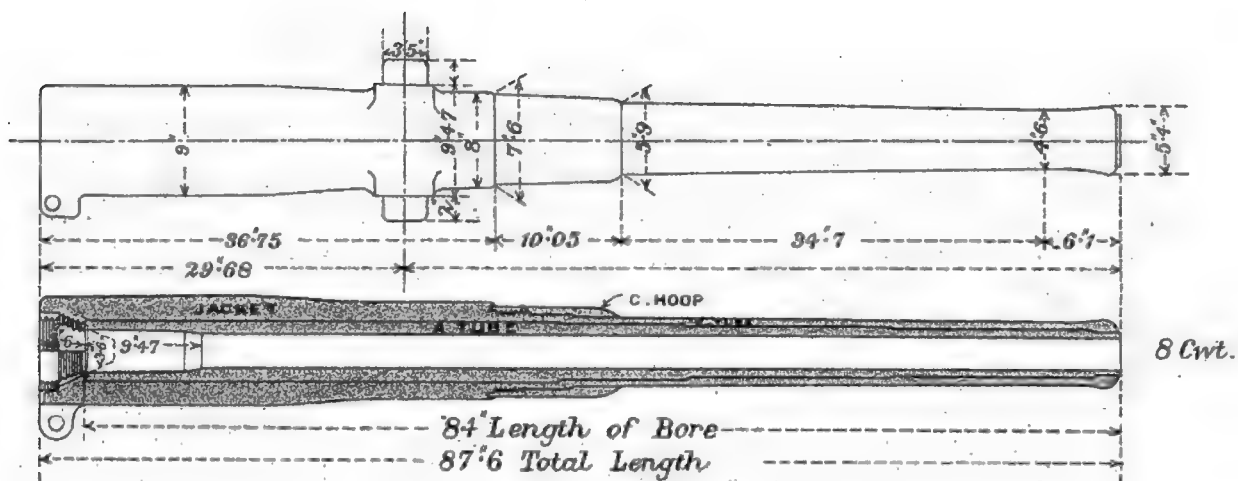
ale $\frac{1}{10}$ 

Plate I.

ORDNANCE. Q. F. 12 PR, 12 AND 8 CWT.

Scale $\frac{1}{10}$

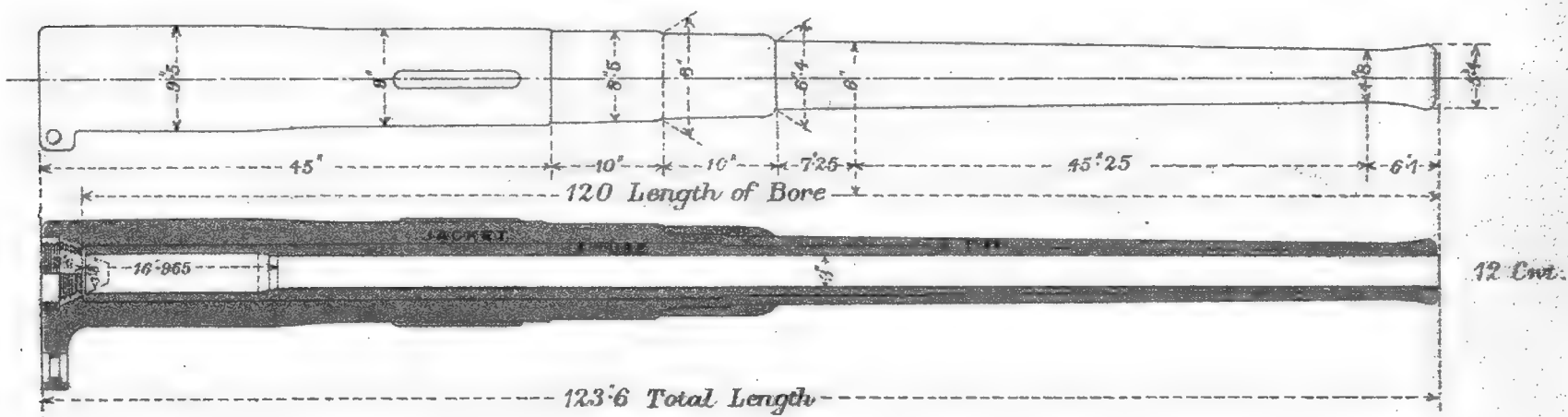
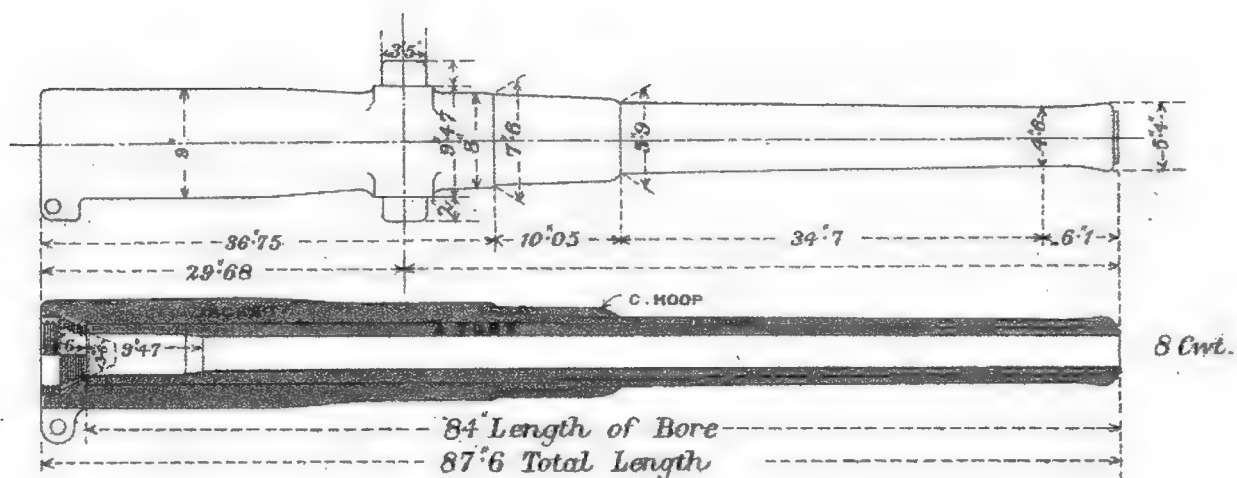


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Plate I.

ORDNANCE. Q. F. 12 PR, 12 AND 8 CWT.

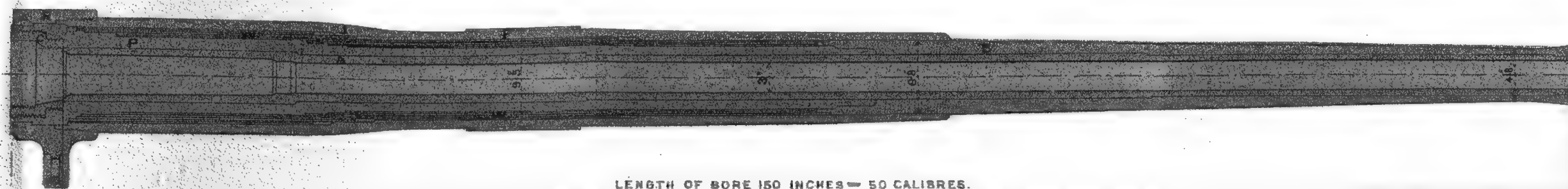
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ORDNANCE 3 INCH Q. F. 18 CWT. MARK I (50 CALIBRE.)

SCALE 1/12".

12 POUNDER.



LENGTH OF BORE 150 INCHES = 50 CALIBRES.

TOTAL LENGTH 154.7 INCHES

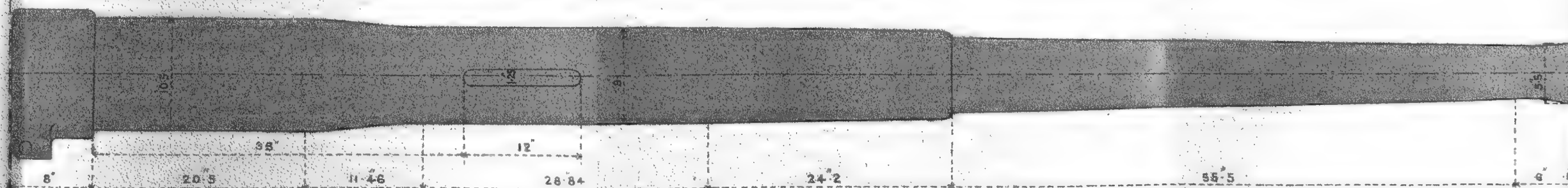
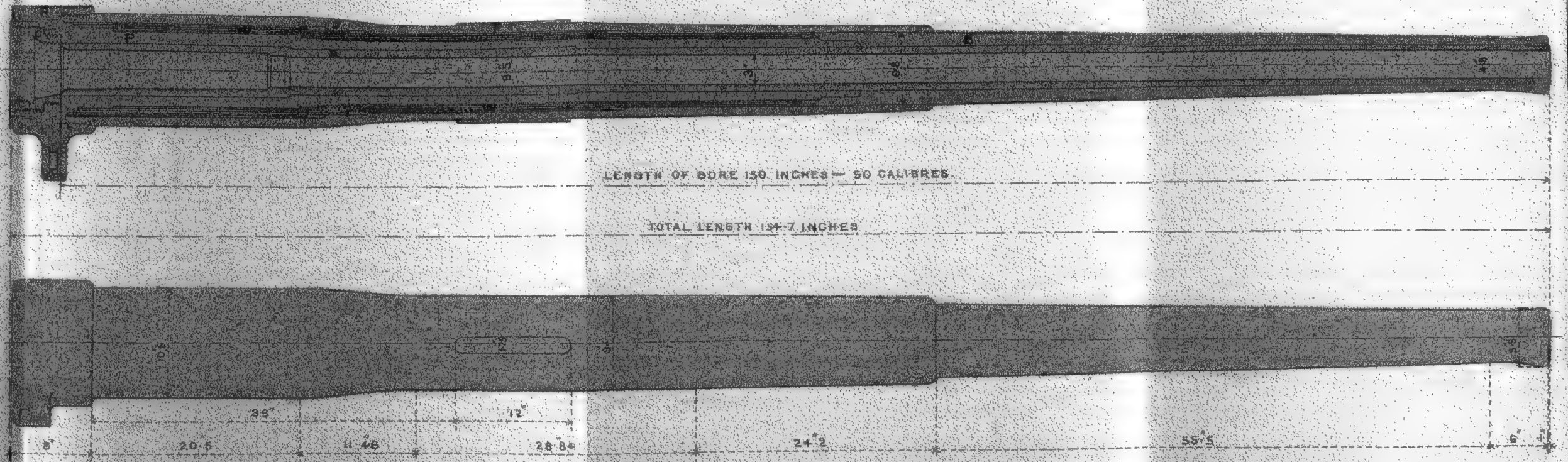


Plate II.

ORDNANCE 3 INCH Q. F. 18 CWT. MARK I (50 CALIBRE)

SCALE $\frac{1}{12}$ "

12 POUNDER.



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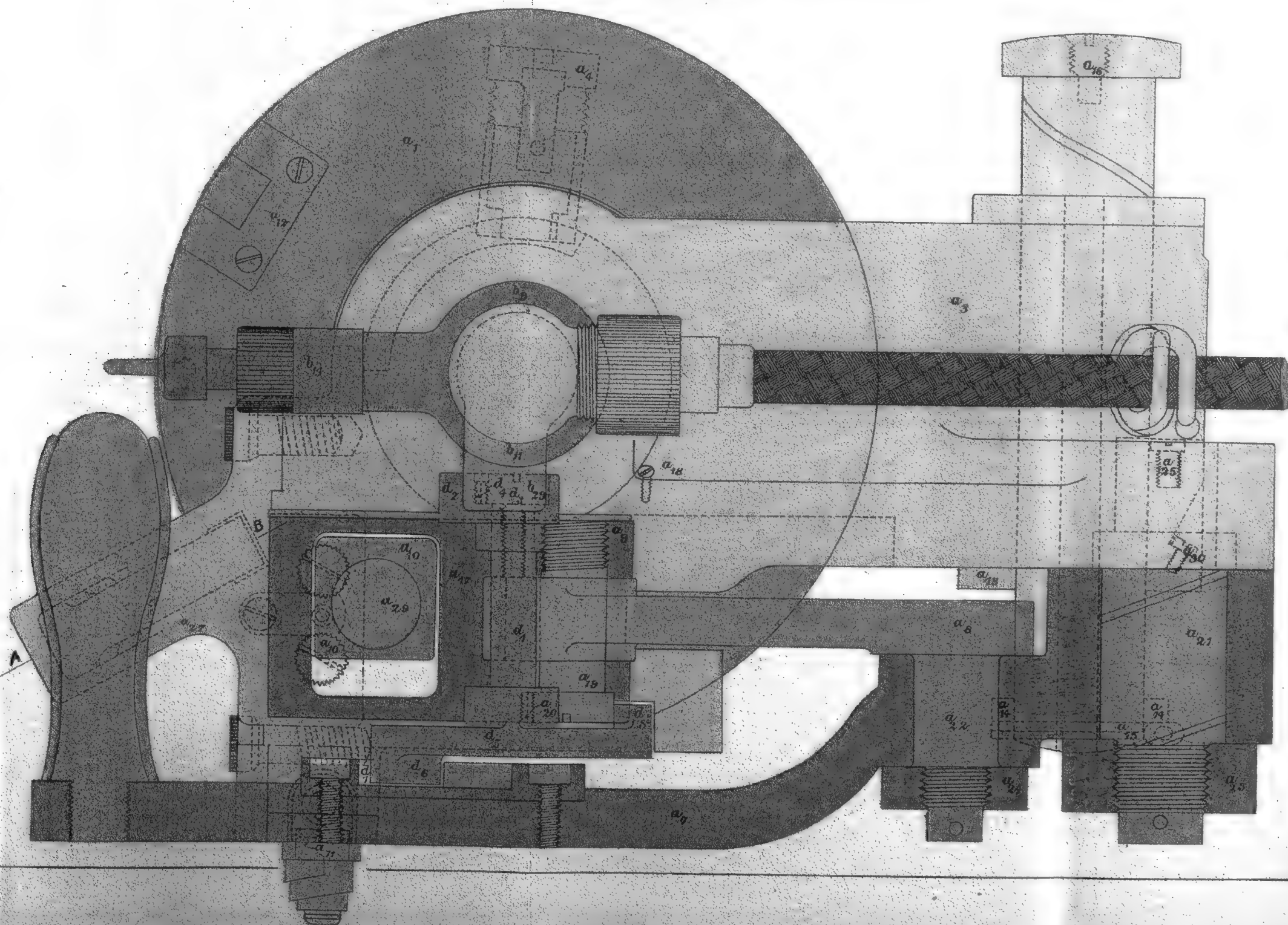
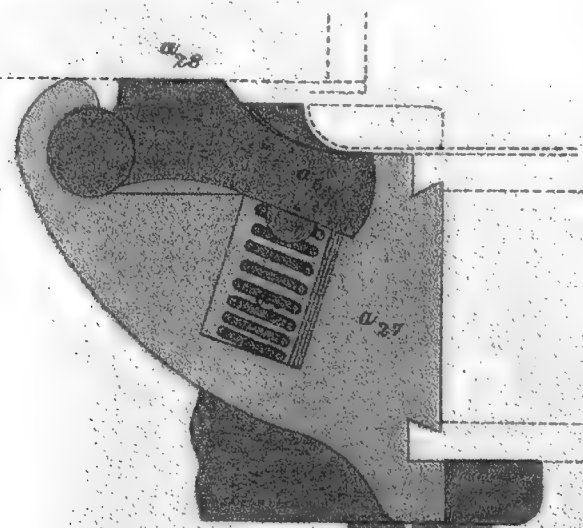
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Plate III

BREECH MECHANISM 12 CWT. A MARK I GUN.

Scale Full Size.

SECTIONAL PLAN AT A.B



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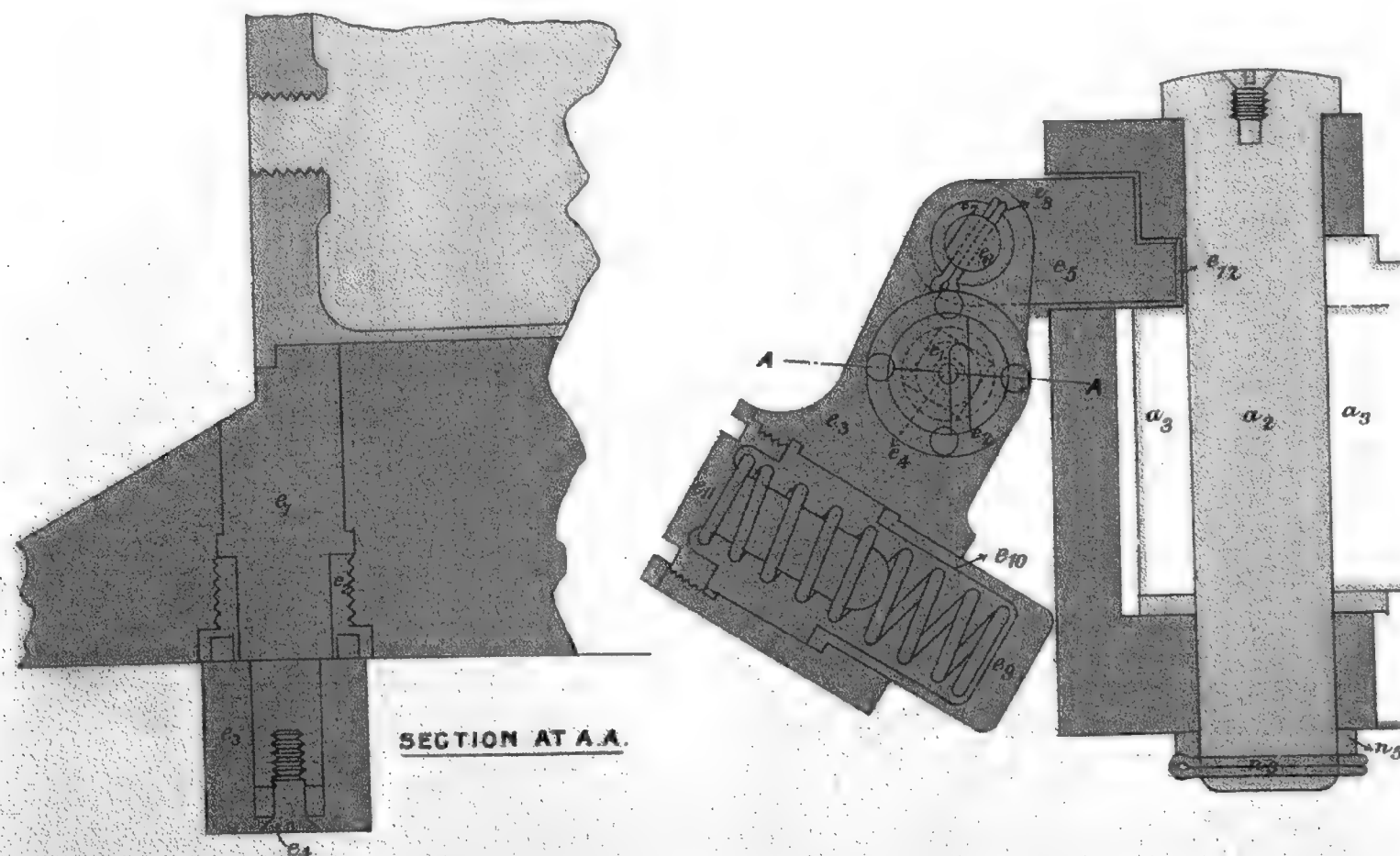
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Plate IV.

EXTRACTOR, (BREECH, CLOSED)

Scale 2/3 Full Size



SECTION AT A.A.

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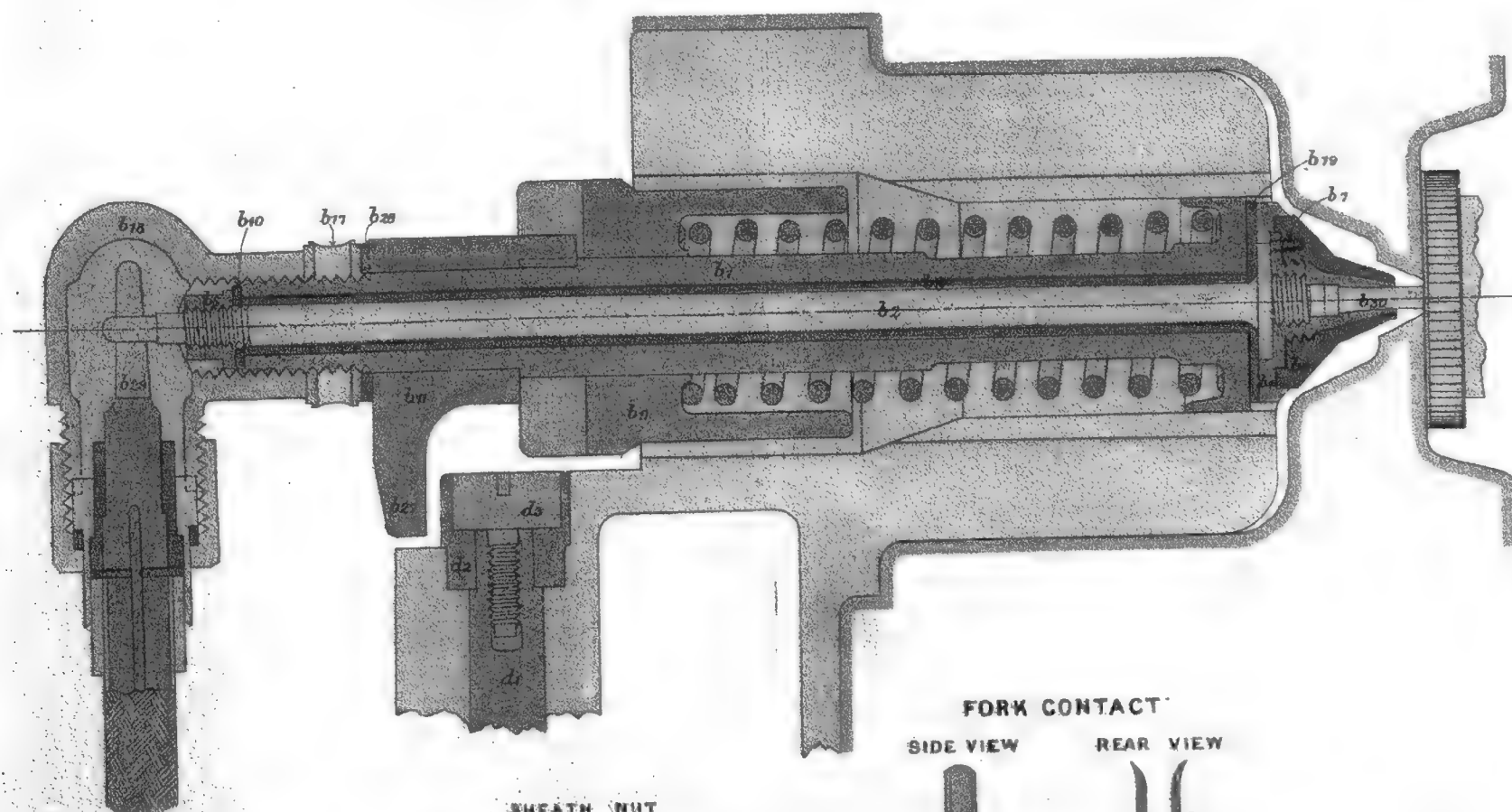
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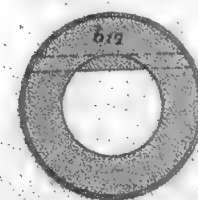
Plate V

STRIKER ELECTRIC AND PERCUSSION.

Full Size.



SHEATH NUT



FORK CONTACT

SIDE VIEW



REAR VIEW



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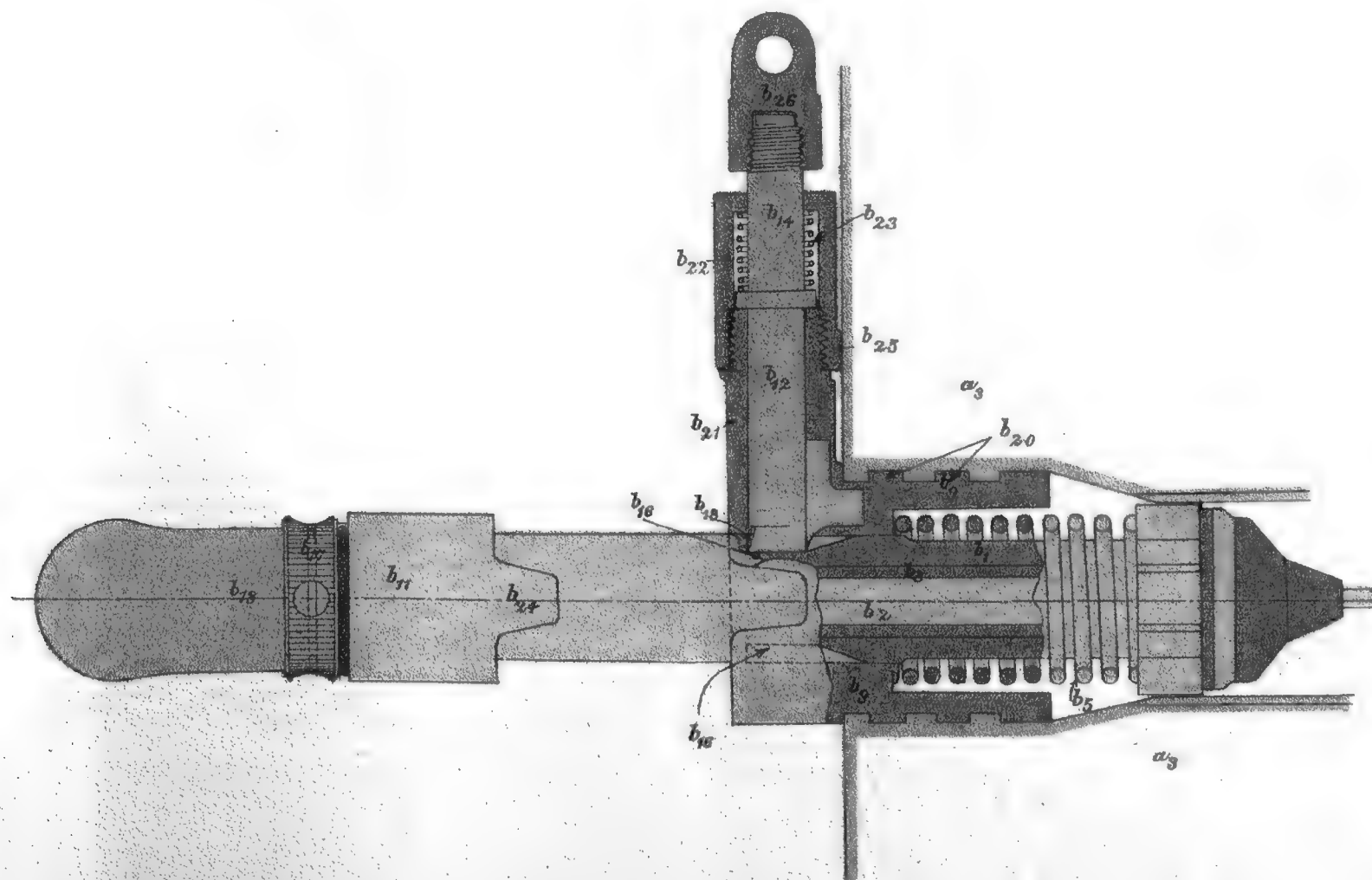
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Plate VI

STRIKER DRAWN BACK FOR PERCUSSION FIRING.

Full Size.



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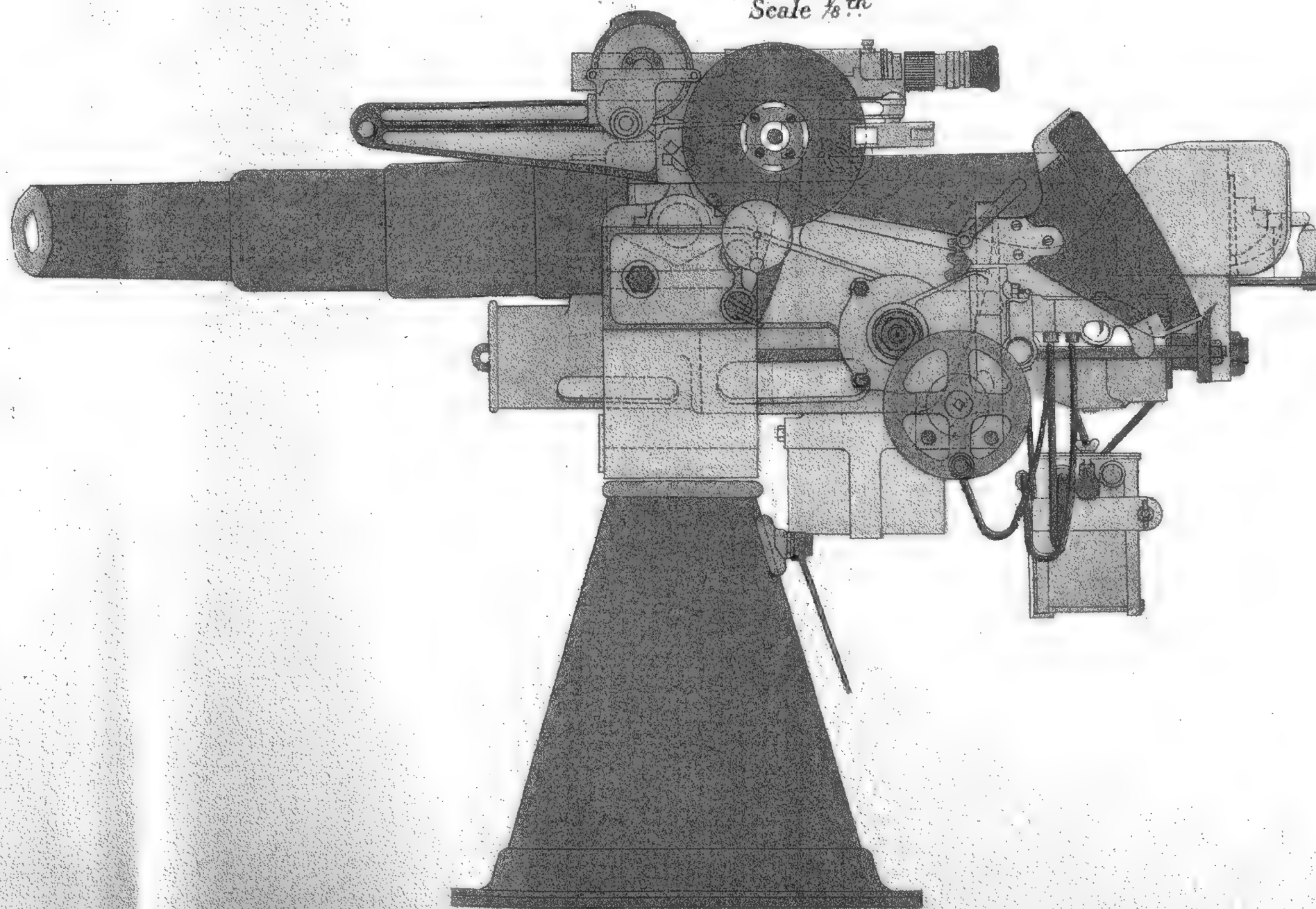
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Plate VII.

12 P^R MOUNTING P. MARK I. GENERAL ARRANGEMENTS.
WITHOUT TRAINING GEAR.

Scale $\frac{1}{8}$ th



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Plate VIII

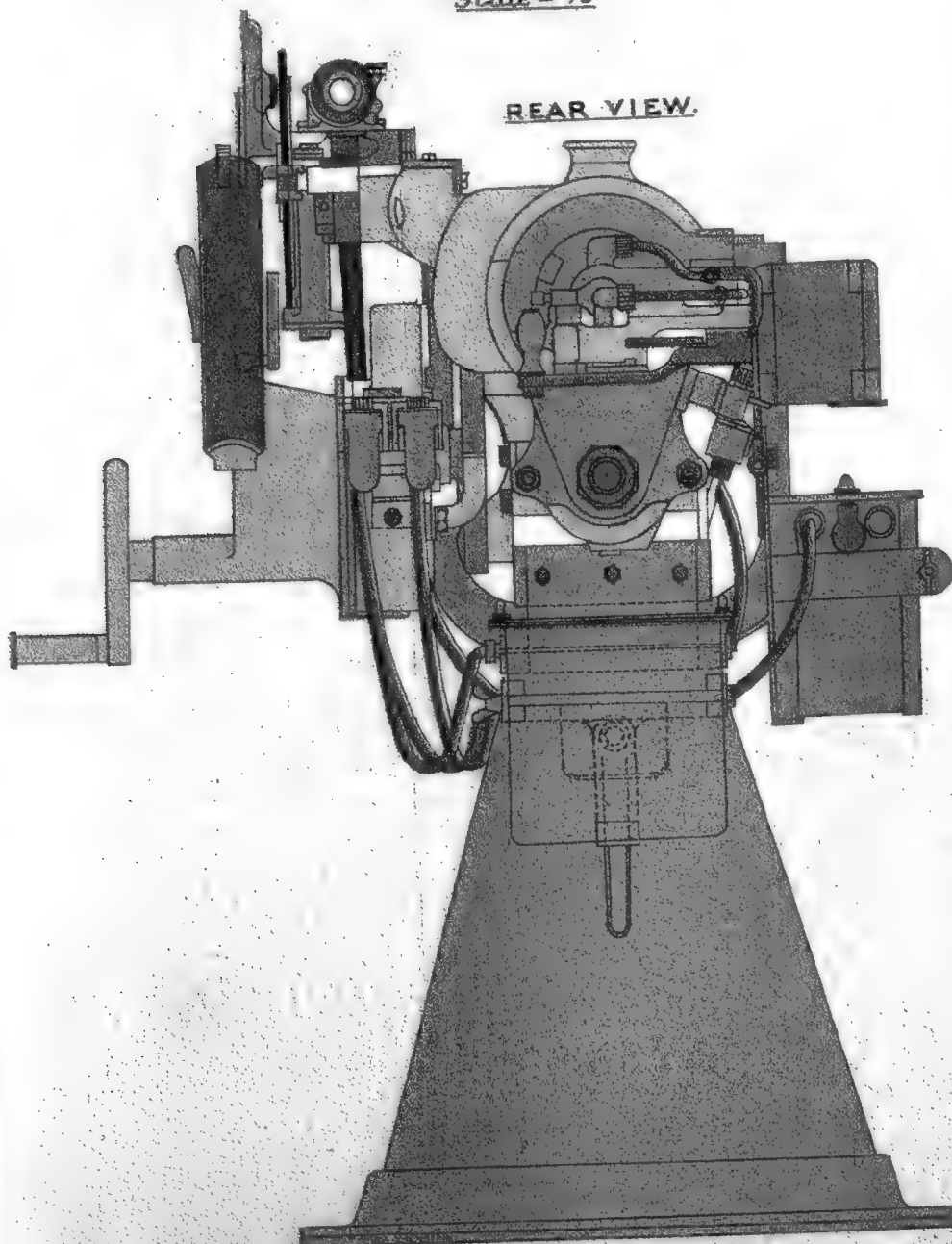
12 P^a MOUNTING. P. MARK I.

GENERAL ARRANGEMENT.

Without Training Gear.

Scale - 1/8

REAR VIEW.



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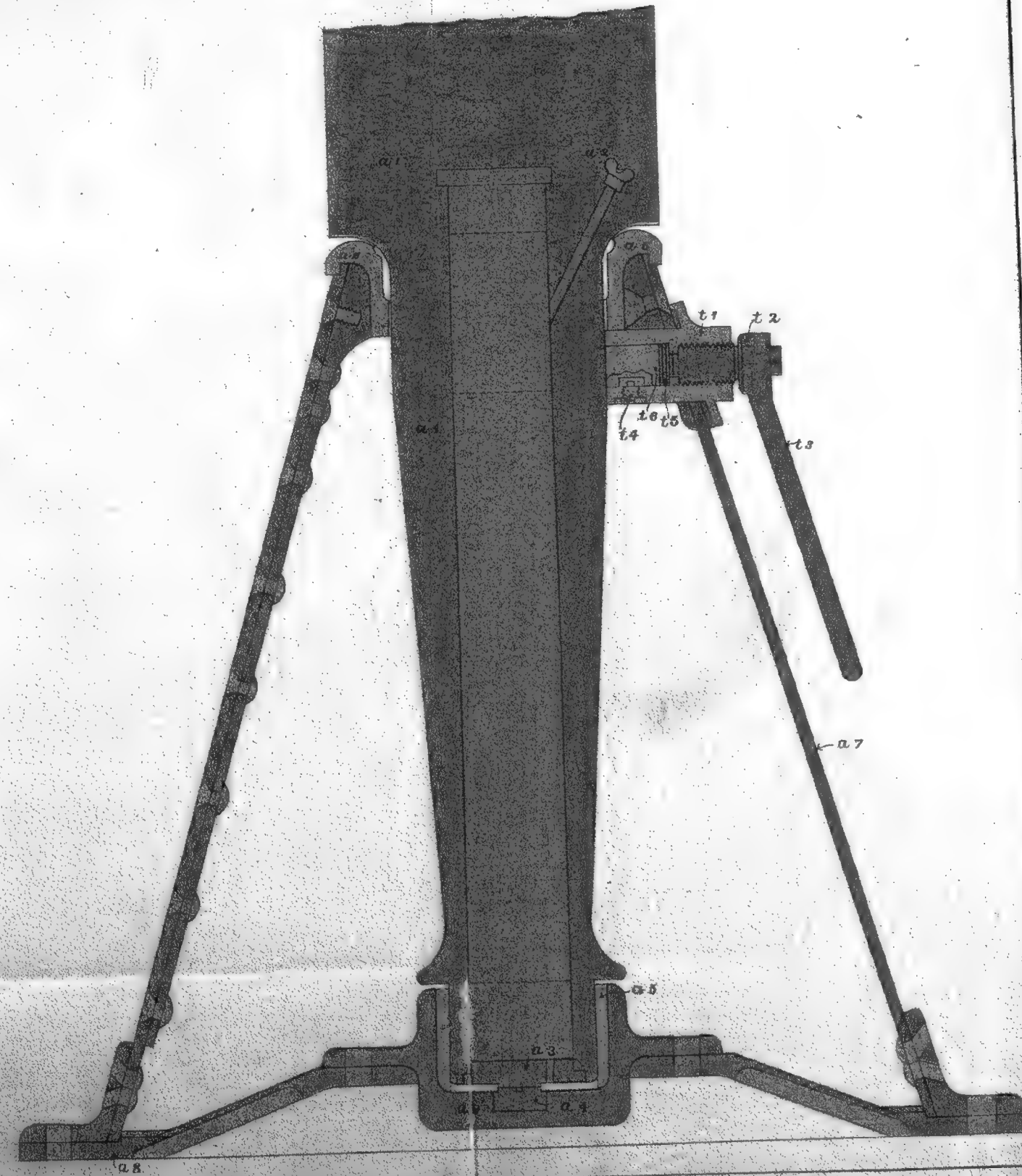
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Plate IX

SECTION OF PEDESTAL P.I. MOUNTING (WITHOUT TRAINING GEAR)

Scale 1/4 Six.



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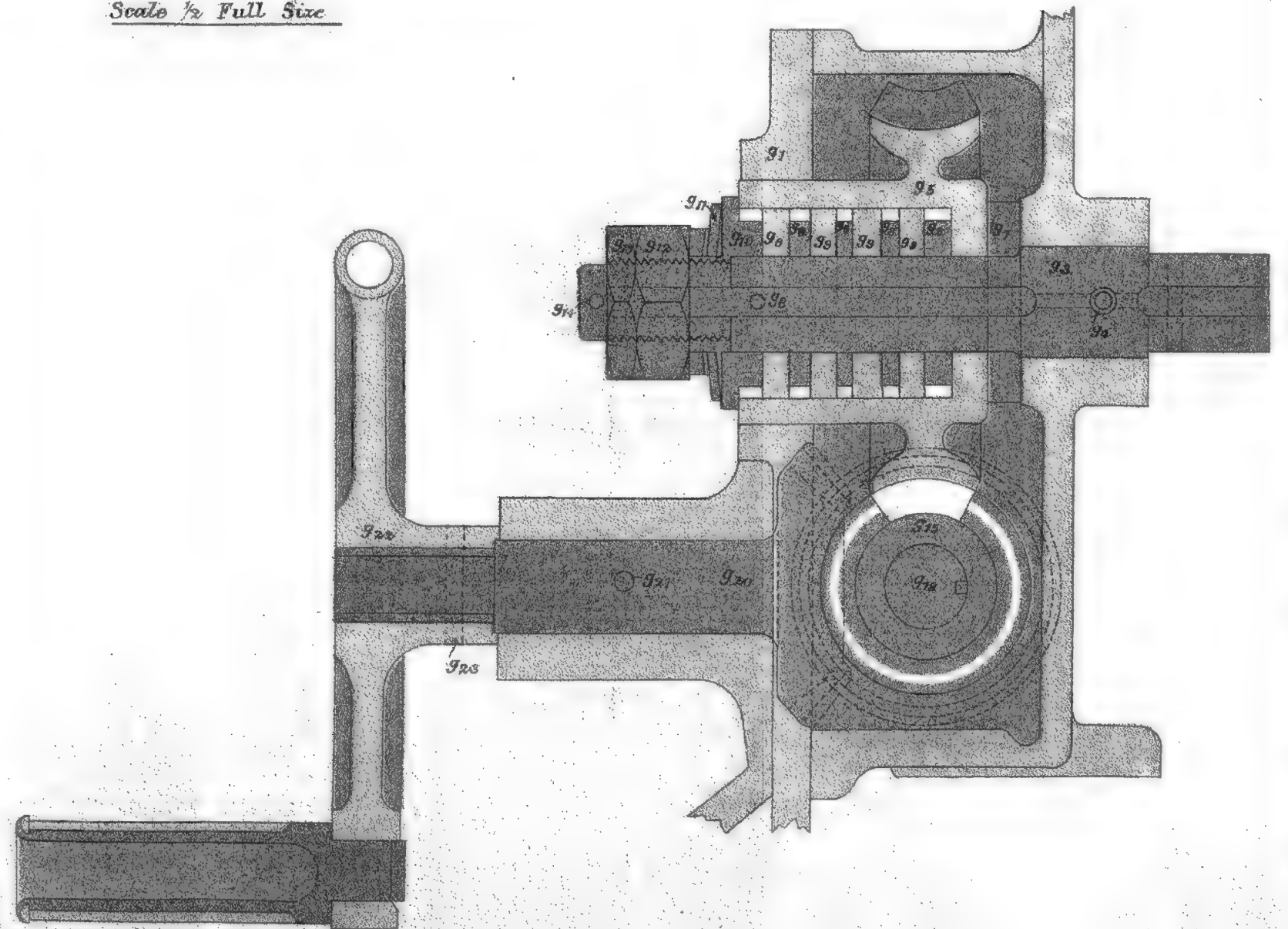
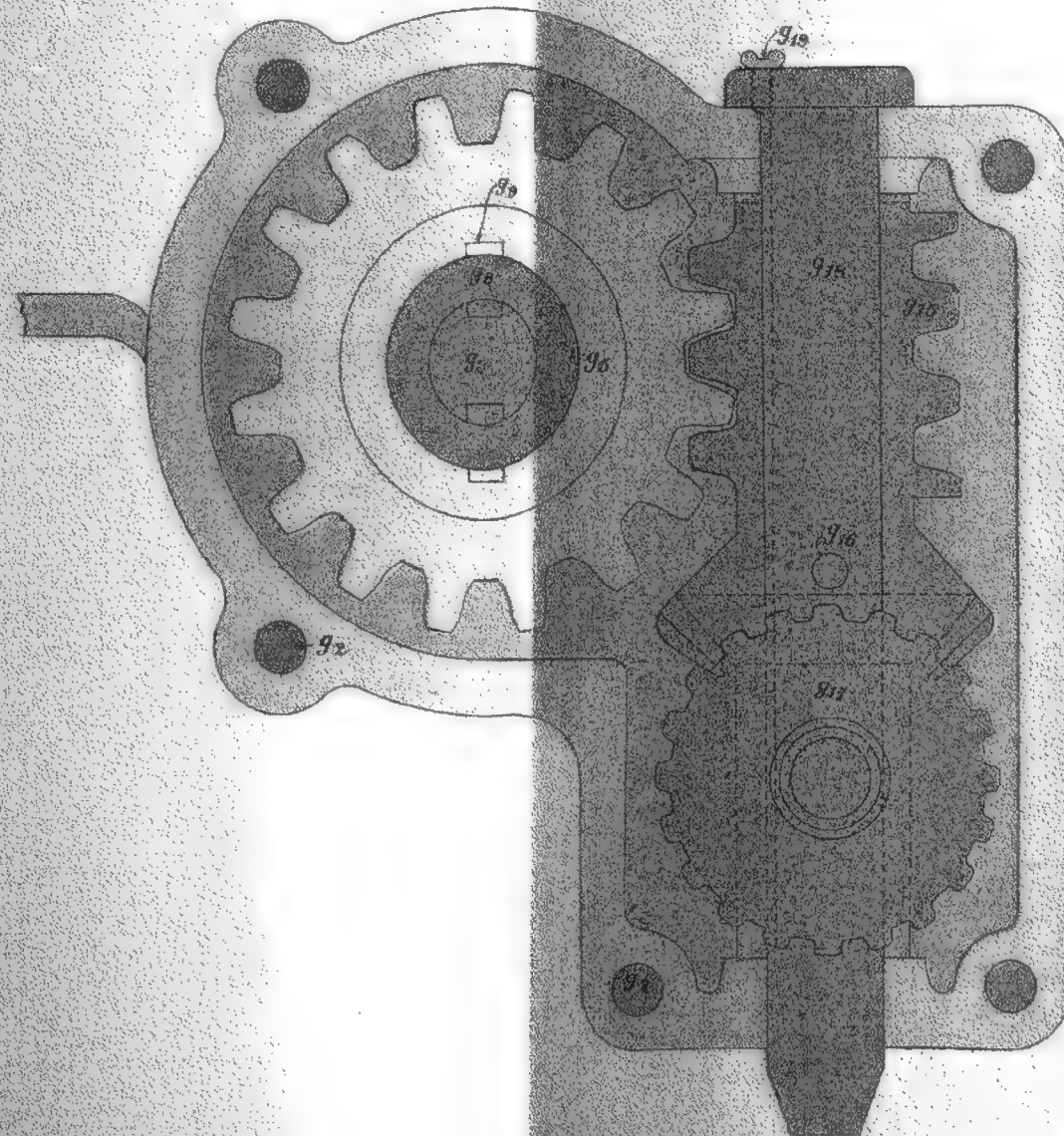
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Plate X

SECTION OF ELEVATING GEAR, P.I.P. IV AND P.IV* MOUNTINGS.

Scale 1/2 Full Size



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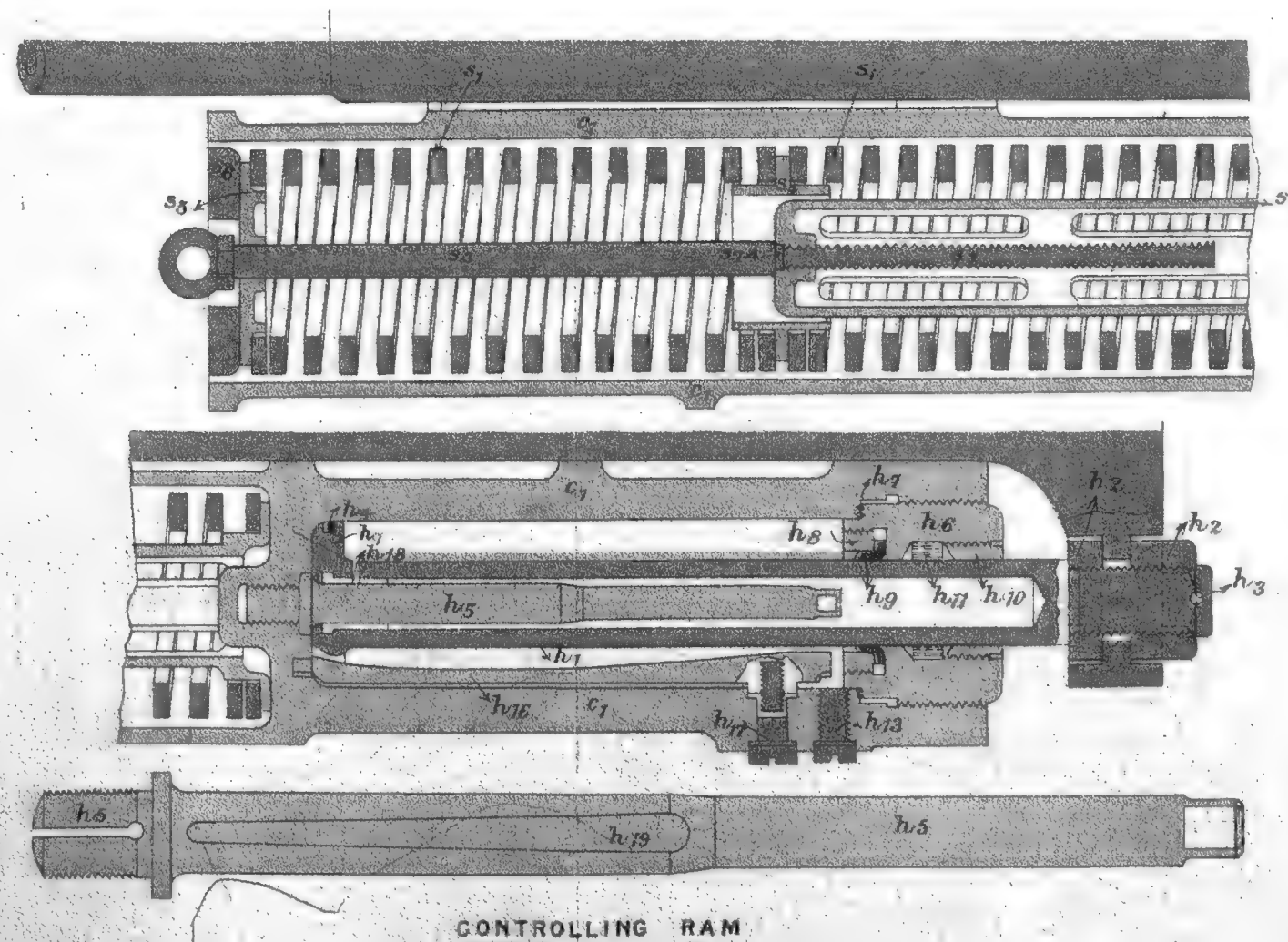
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Plate XI

SECTION OF RECOIL CYLINDER AND SPRING BOX FOR 12 PR P. I.

Scale 1/4 Full Size.



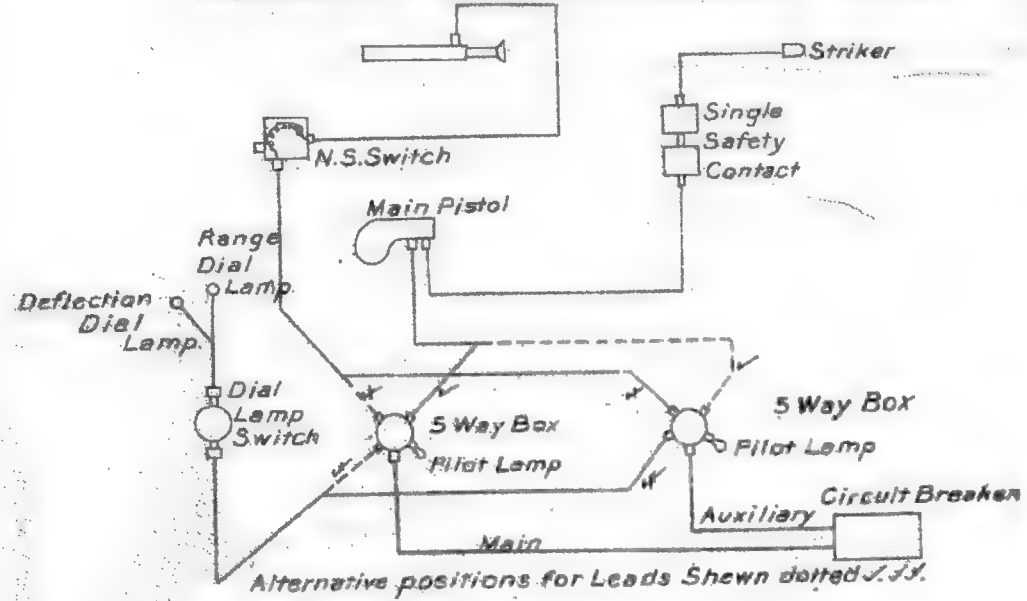
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Plate XII.

DIAGRAM OF SII CIRCUITS FOR DYNAMO FIRING.



12 P S II MOUNTING.

Scale 1/8.

SECTIONAL ELEVATION.

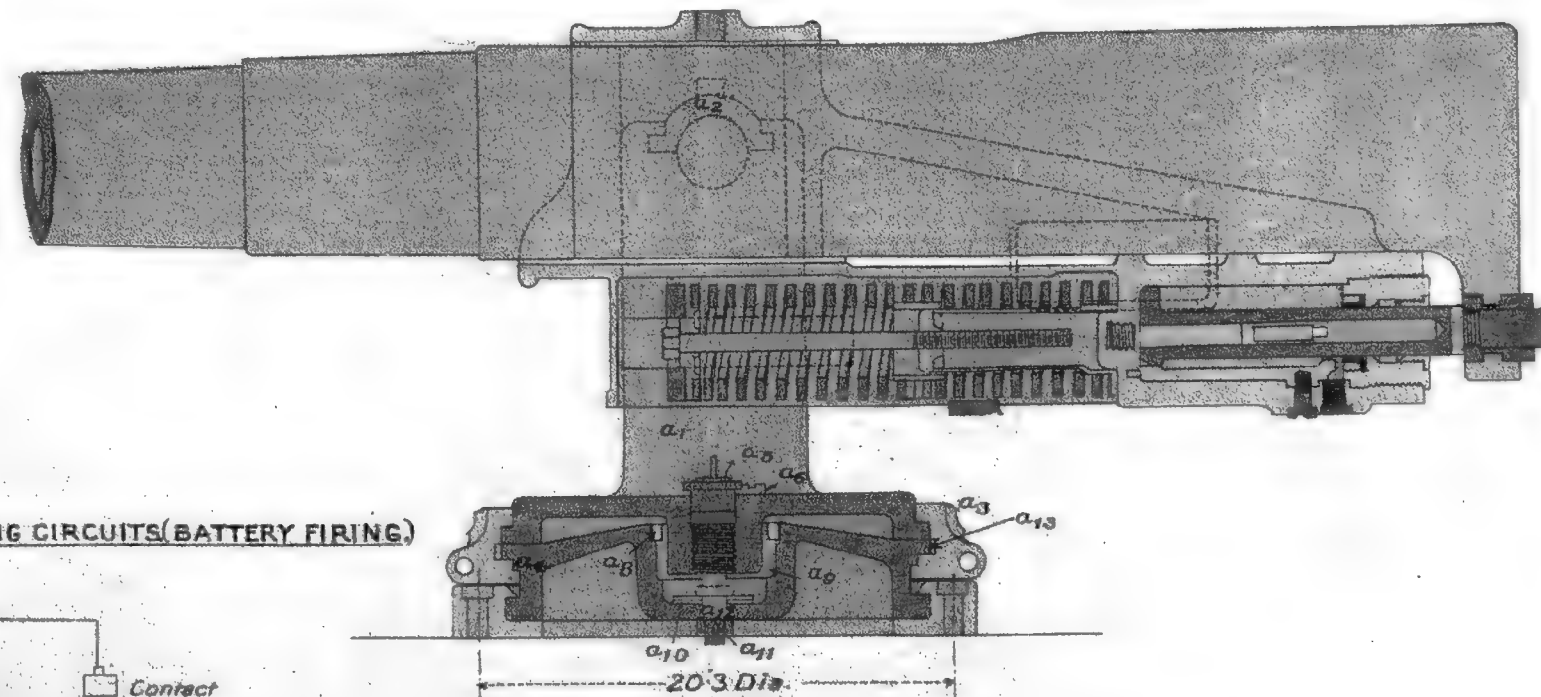


DIAGRAM OF NIGHT SIGHT CIRCUITS.

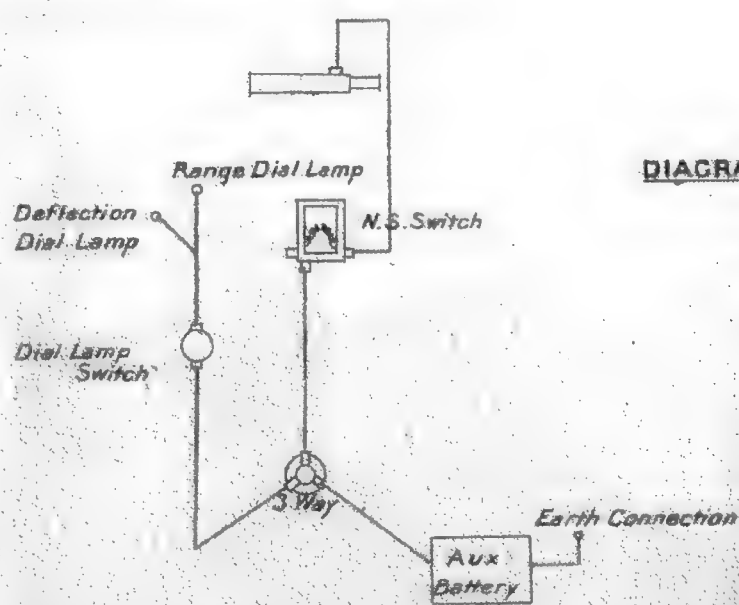
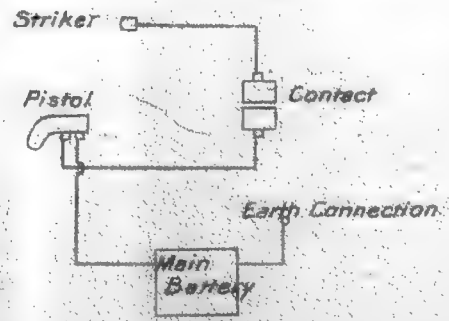


DIAGRAM OF FIRING CIRCUITS (BATTERY FIRING)



12 P. S. II. MOUNTING.
ARRANGEMENT OF TRAINING AND CLAMPING GEARS.

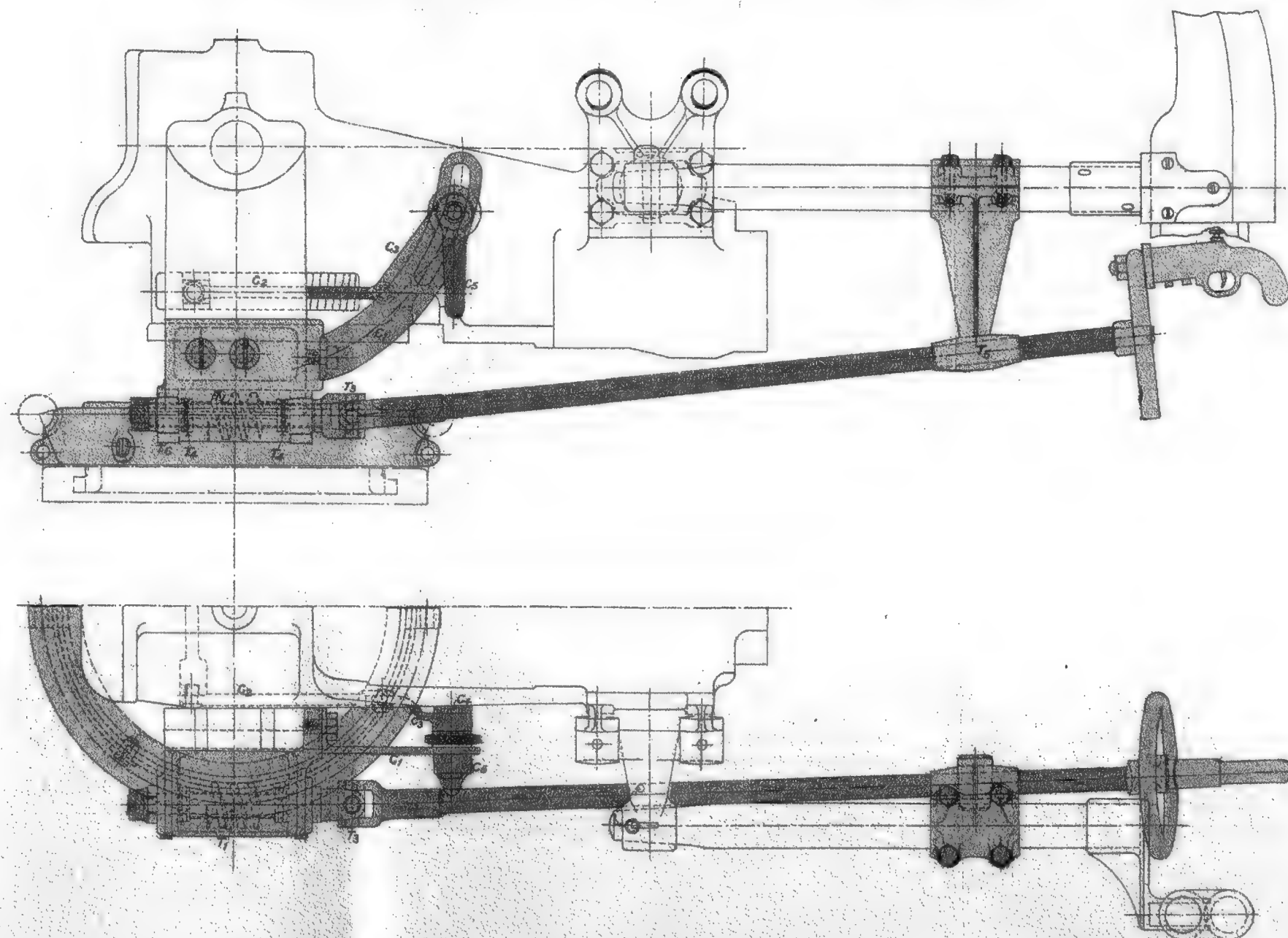
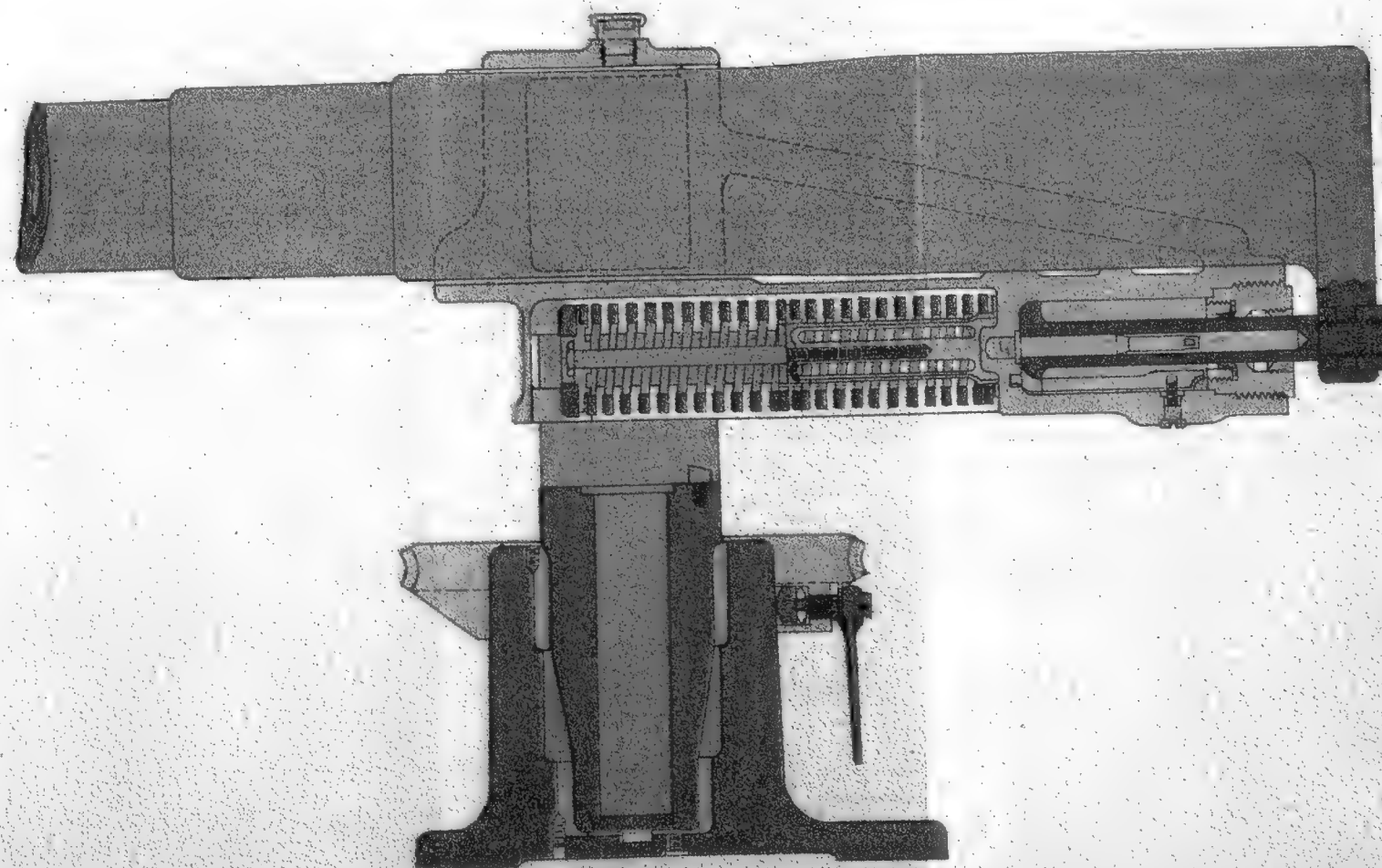


Plate XIV

12 PR. PIII MOUNTING

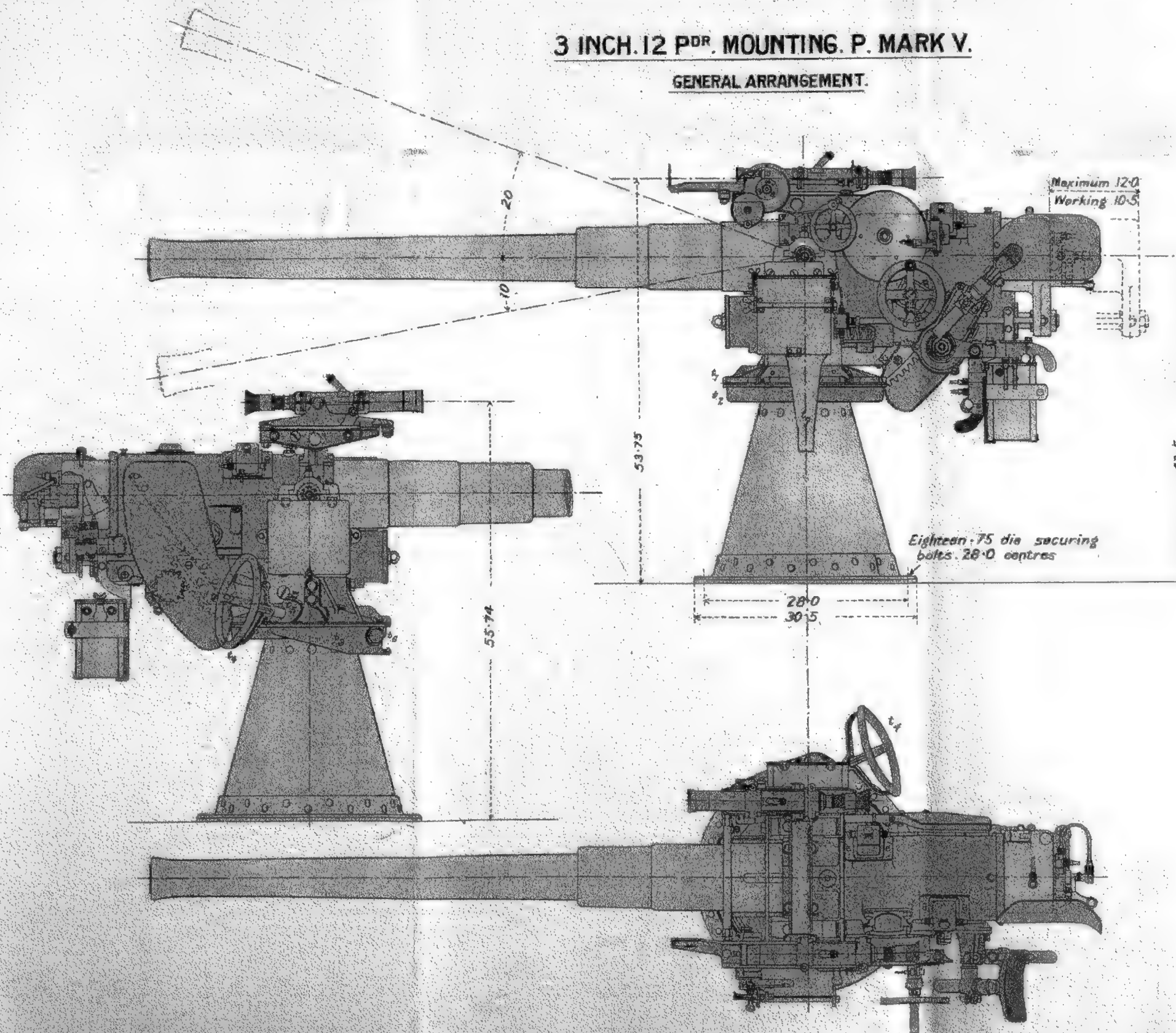
Scale 1/2"

SECTIONAL ELEVATION



3 INCH. 12 PDR. MOUNTING. P. MARK V.

GENERAL ARRANGEMENT.



12 PDR. PV DIAGRAM OF FIRING CIRCUITS

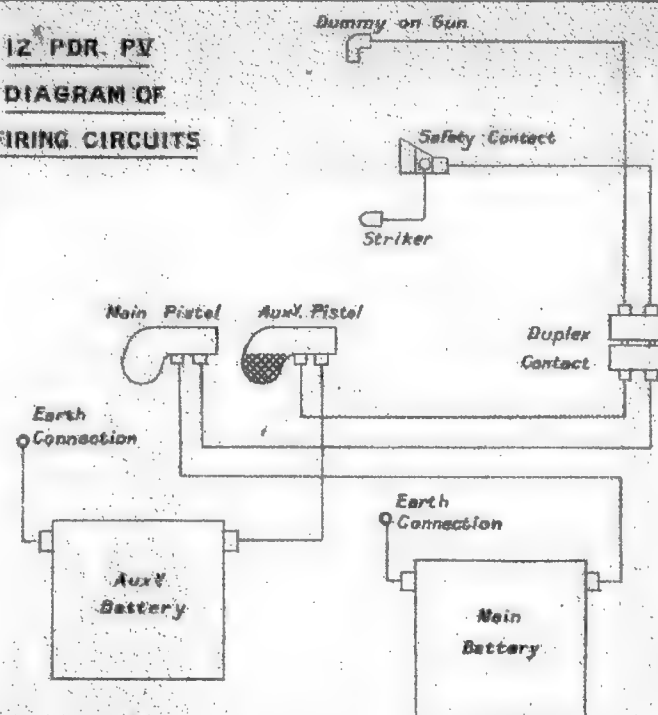


DIAGRAM OF NIGHT SIGHT CIRCUITS

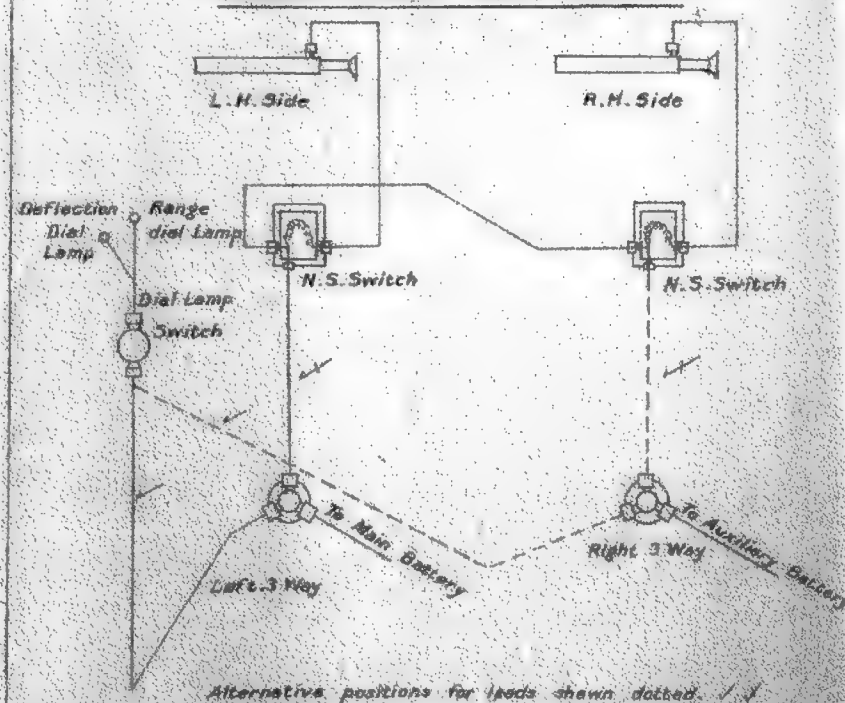
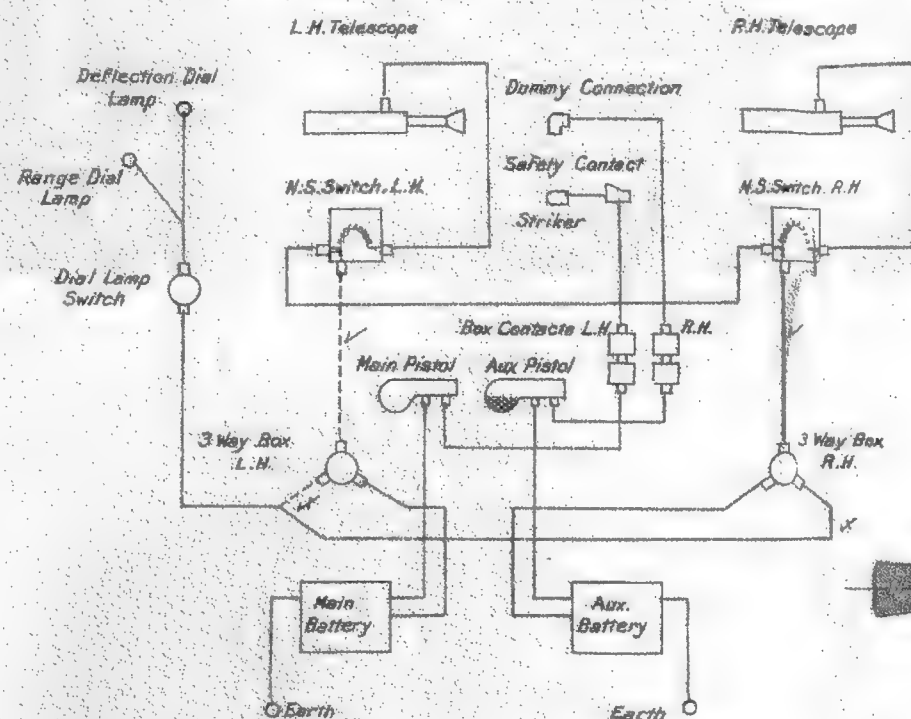
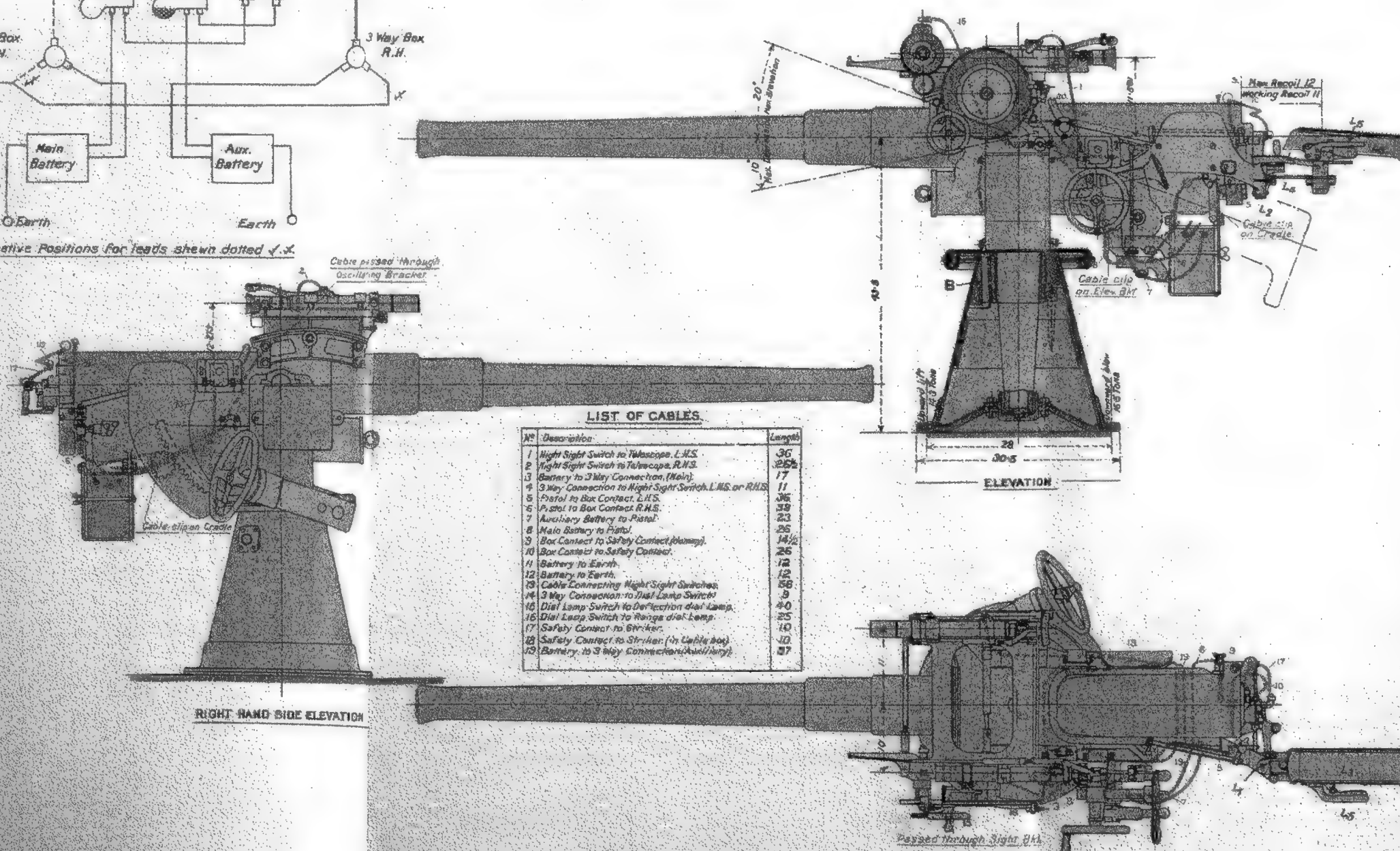


DIAGRAM OF P. VI. CIRCUITS



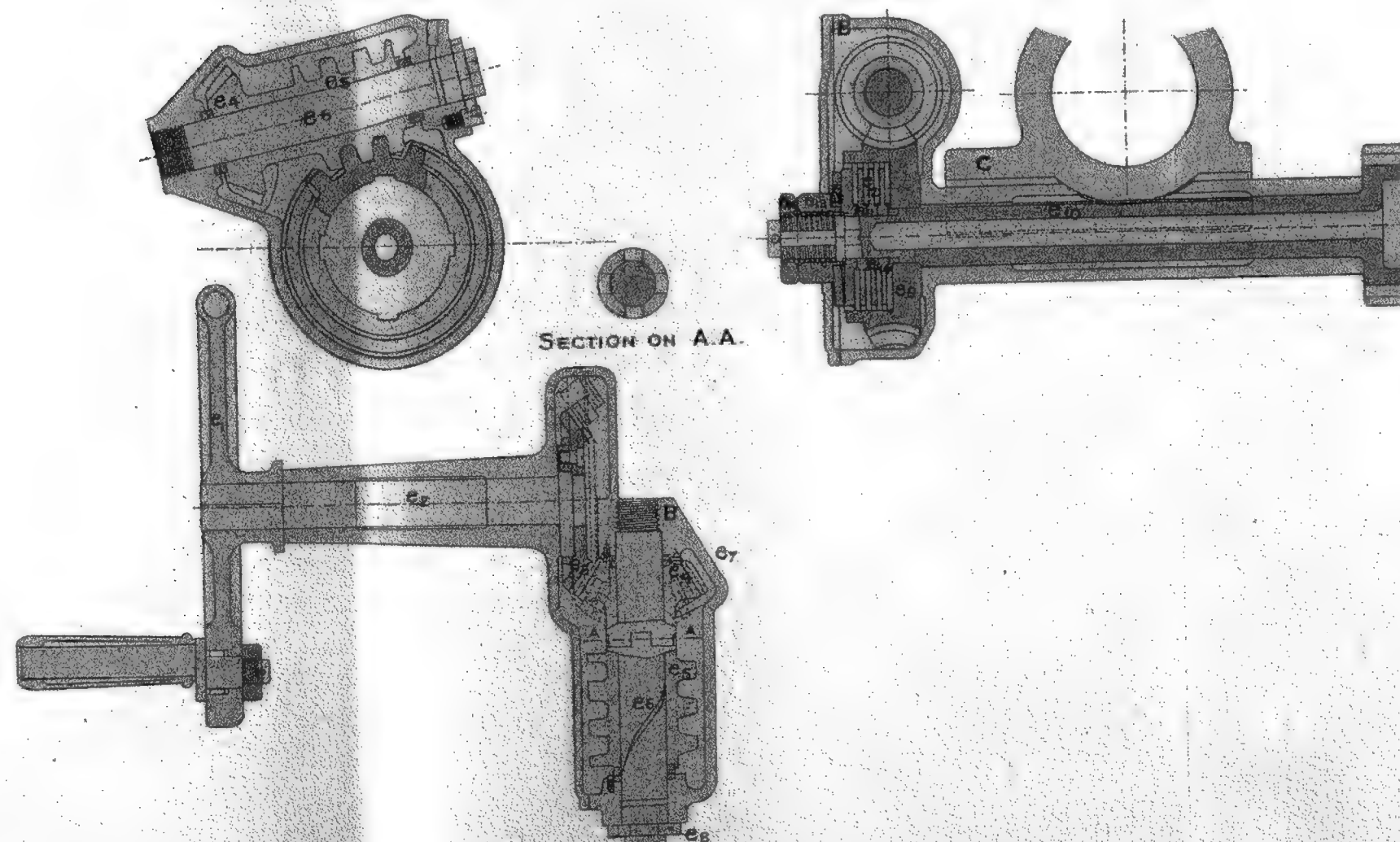
ORDNANCE Q.F. 3 INCH, 12 PDR. P. MARK VI.

PEDESTAL MOUNTING.



ORDNANCE Q.F. 3 INCH, 12 PDR, P. MARK VI.

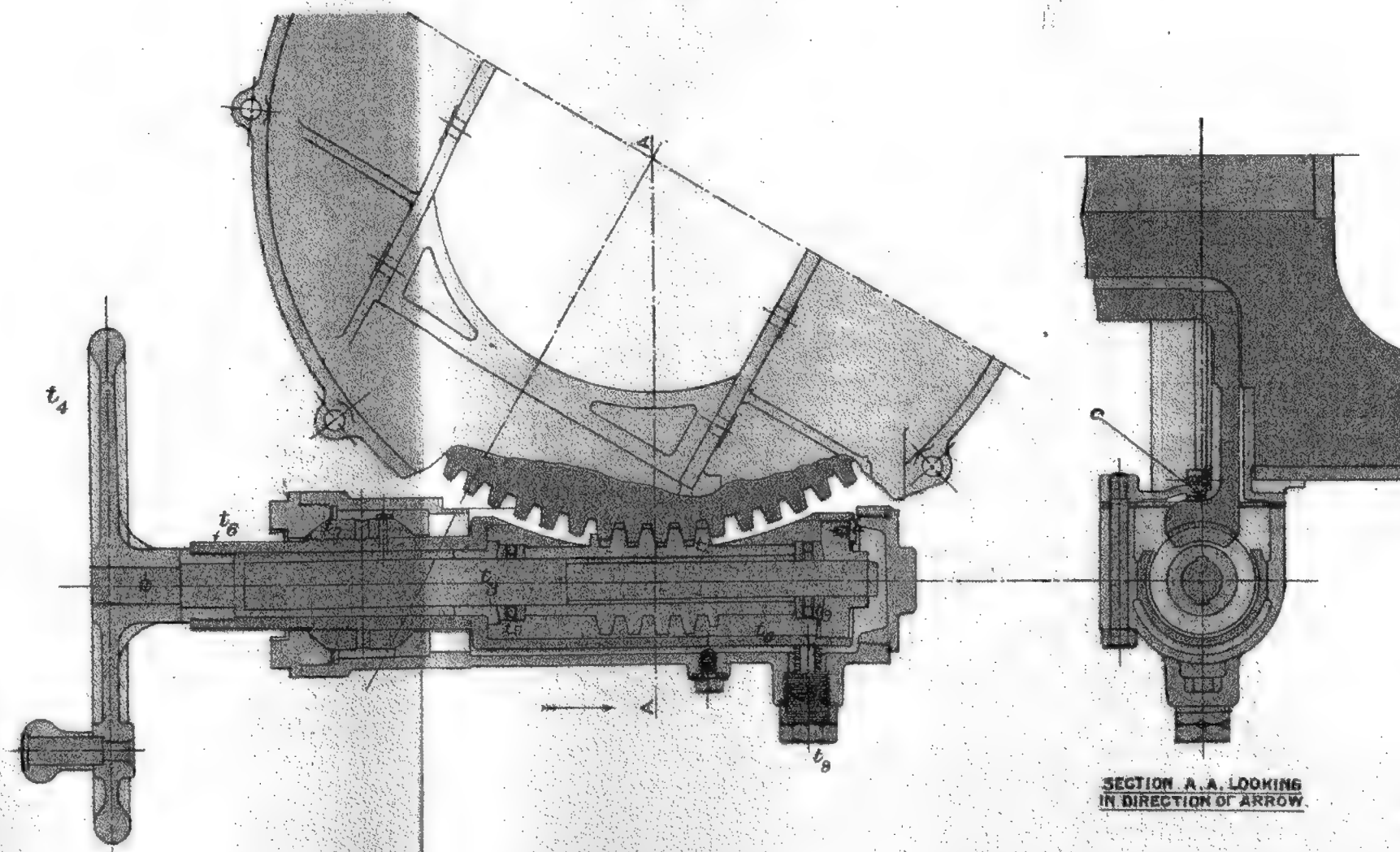
ELEVATING GEAR.



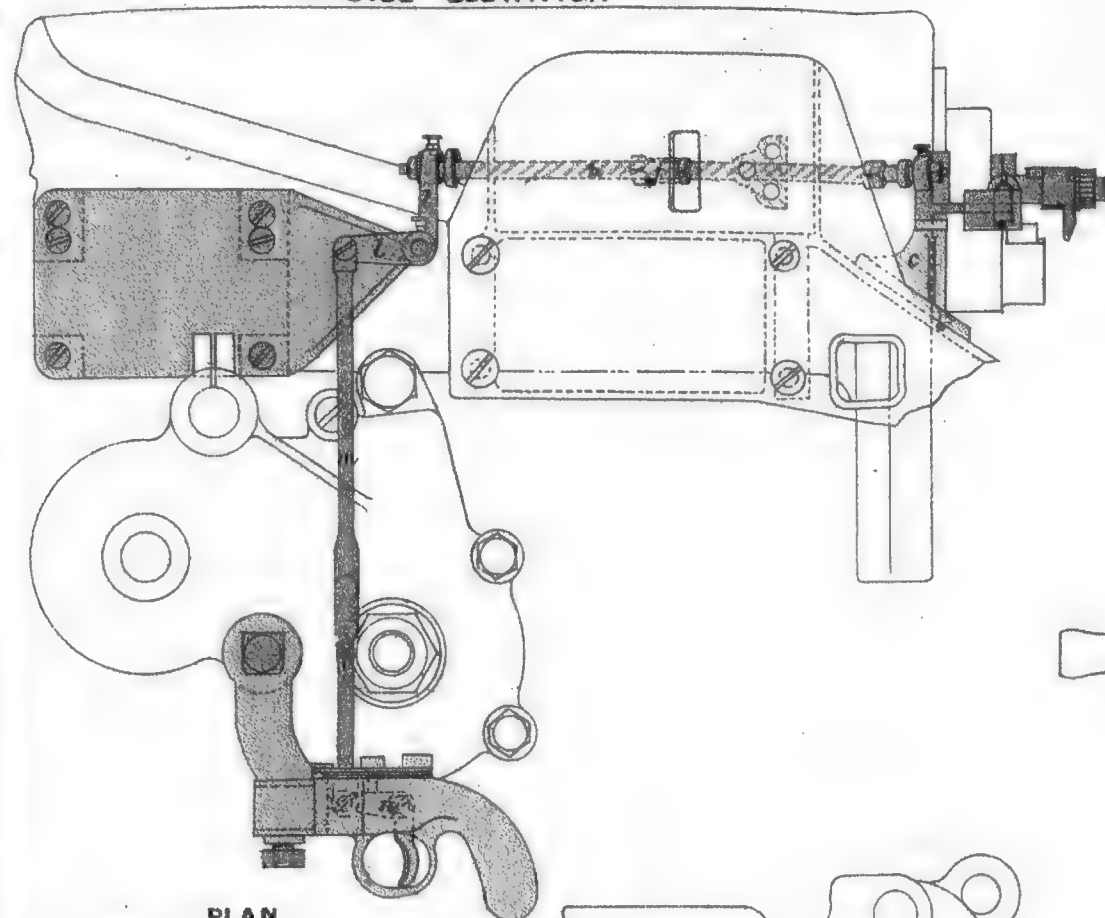
ORDNANCE Q. F. 3 INCH, 12 PDR, P. MARK VI.

31419 G

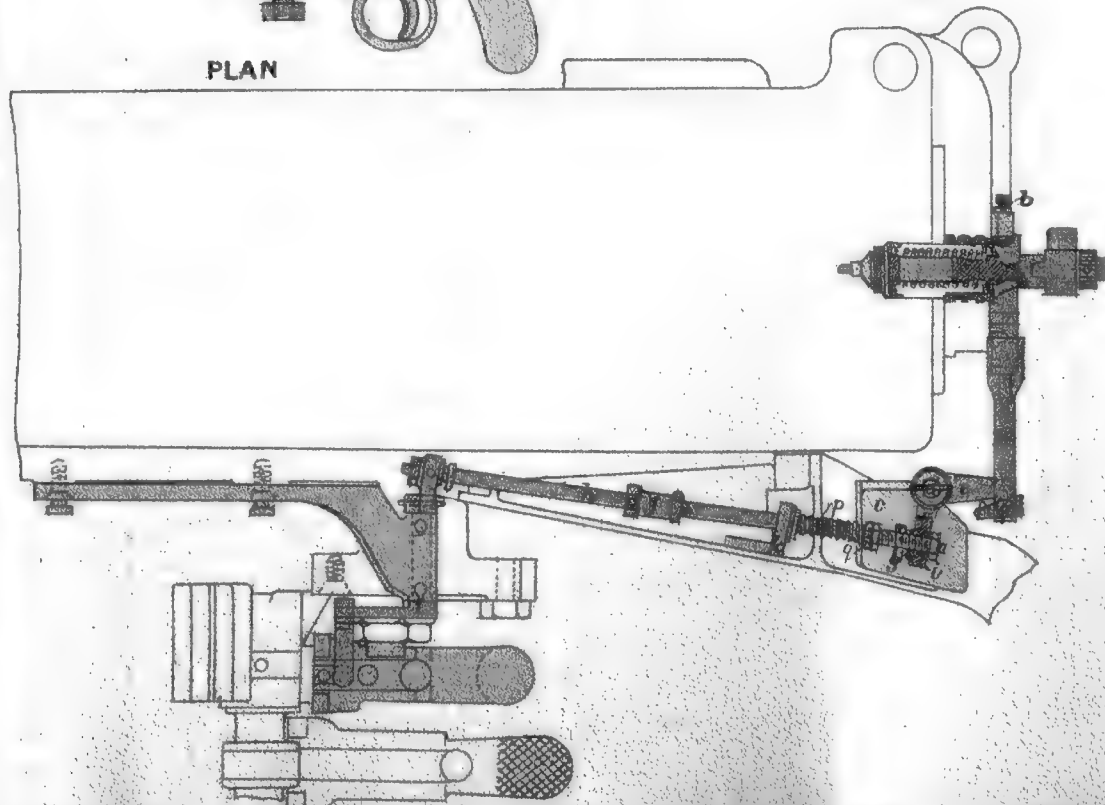
TRAINING GEAR.



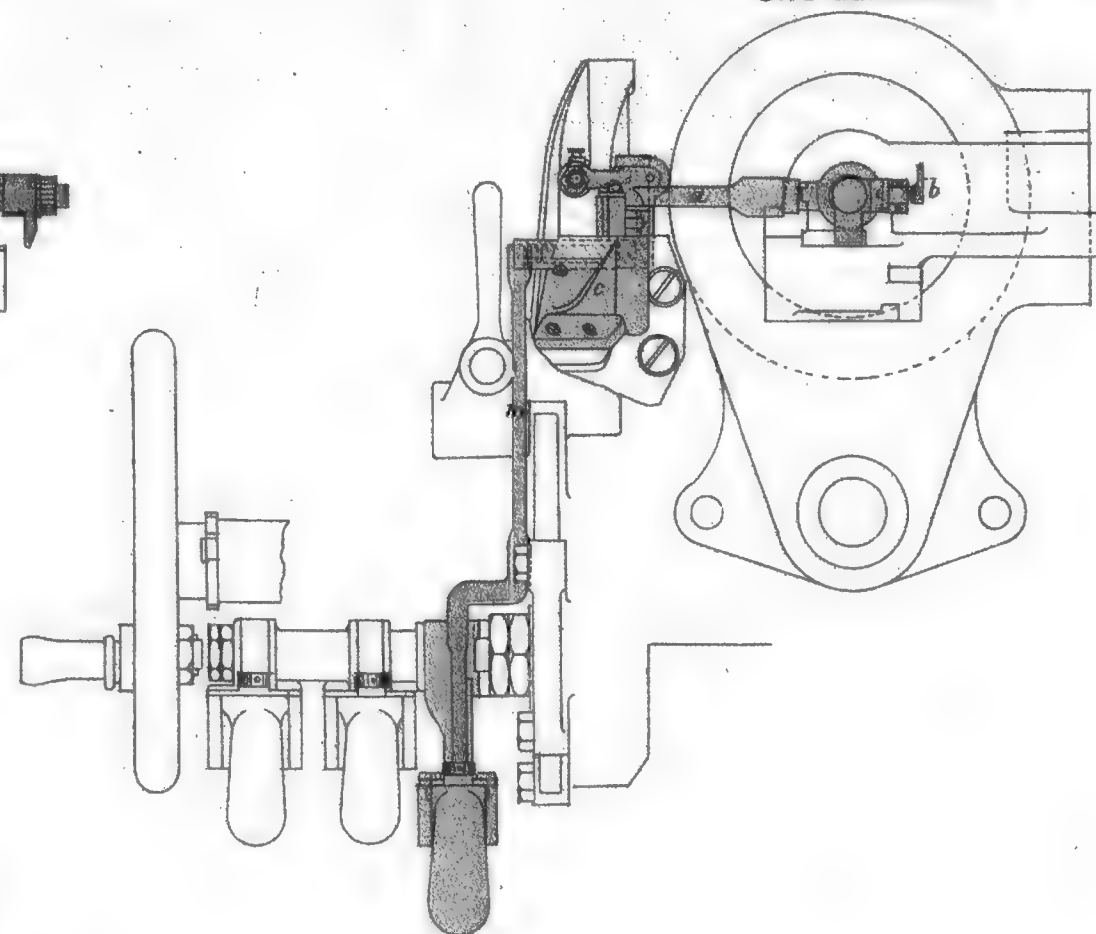
SIDE ELEVATION



PLAN



END ELEVATION

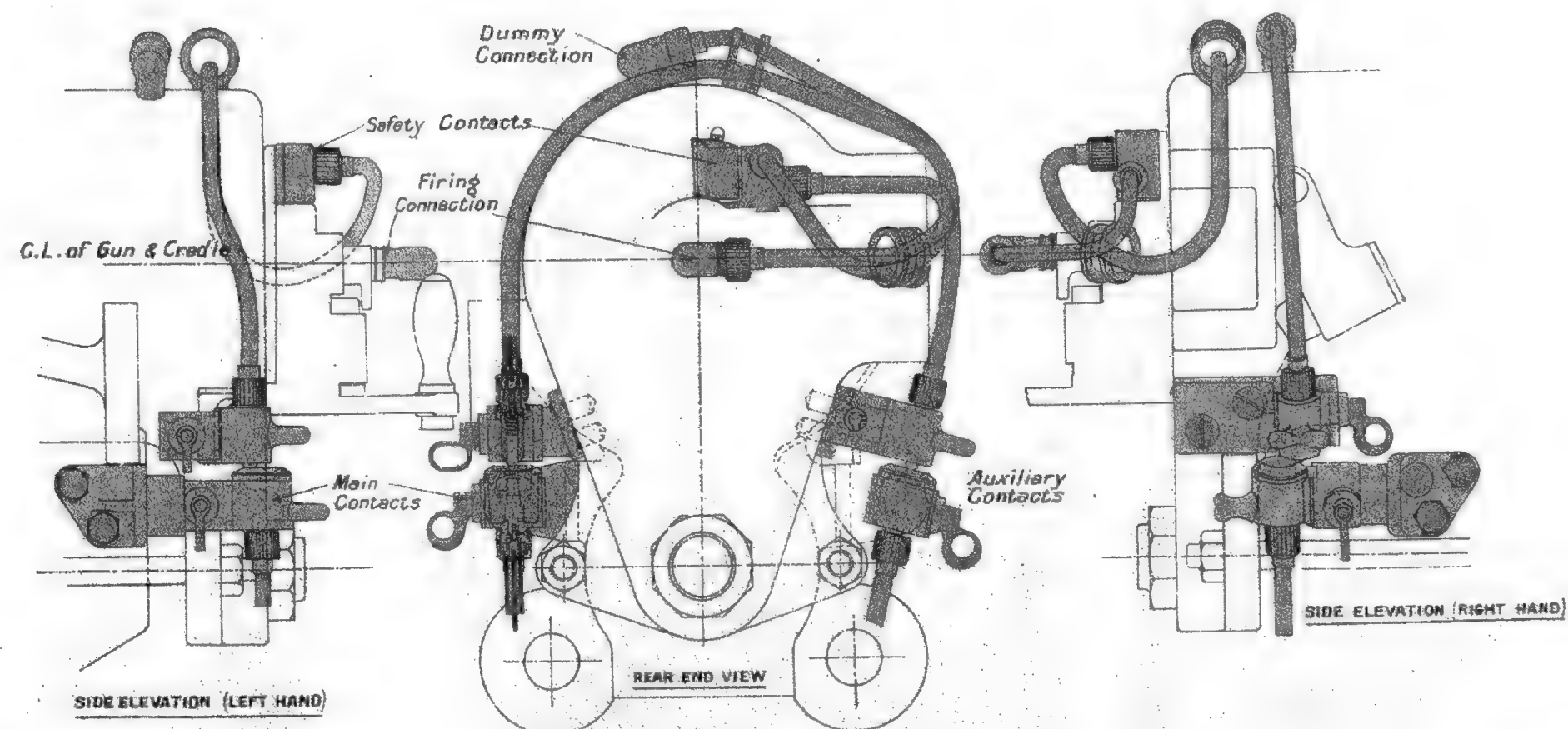


12 PR PVI PERCUSSION FIRING GEAR.

GENERAL ARRANGEMENT.

Scale = 1/5.

31420,6

ORDNANCE Q.F. 3 INCH, 12 PDR, P MARK VI,MAIN & AUXILIARY CONTACTS ON GUN.

12 P^R MOUNTING P. MARK IV. SIDE ELEVATION.

Scale 1/8.

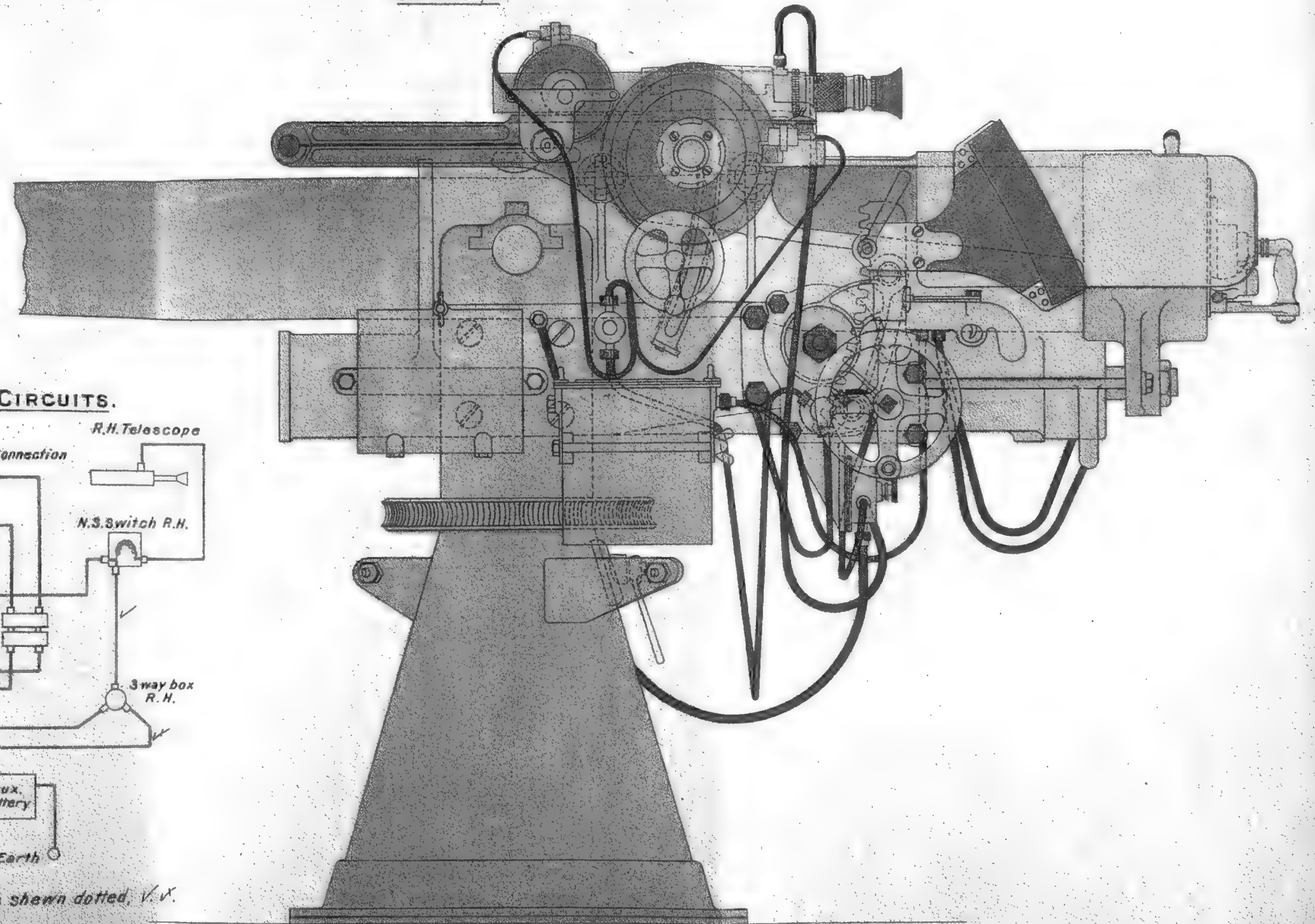


DIAGRAM OF P IV CIRCUITS.

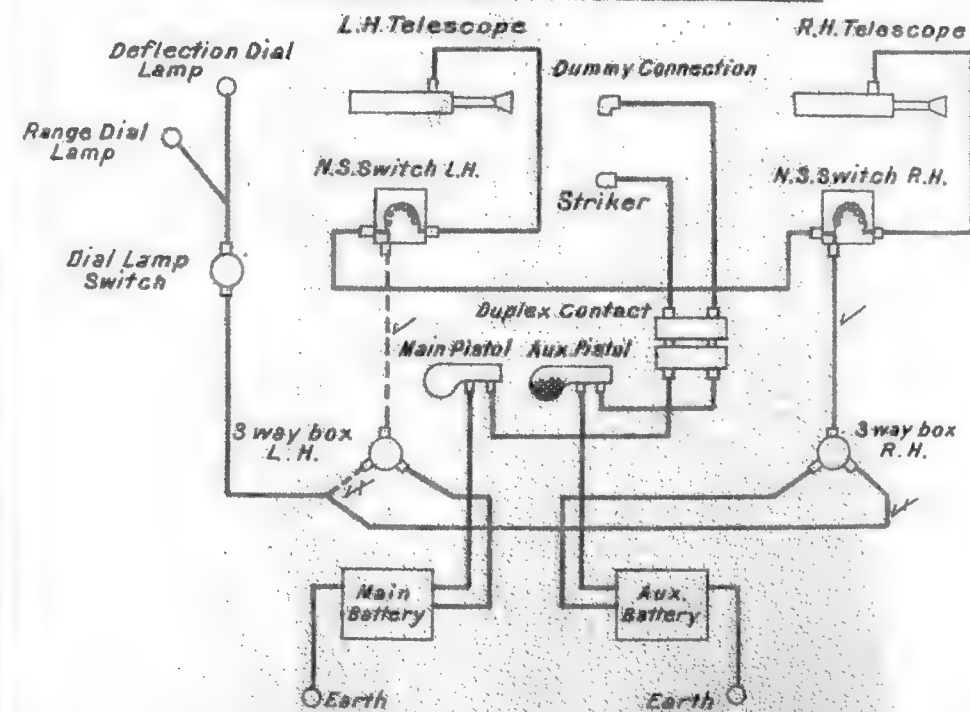


Plate XXII

12 PR MOUNTING P. MARK IV. REAR VIEW.

SCALE - 1/8.

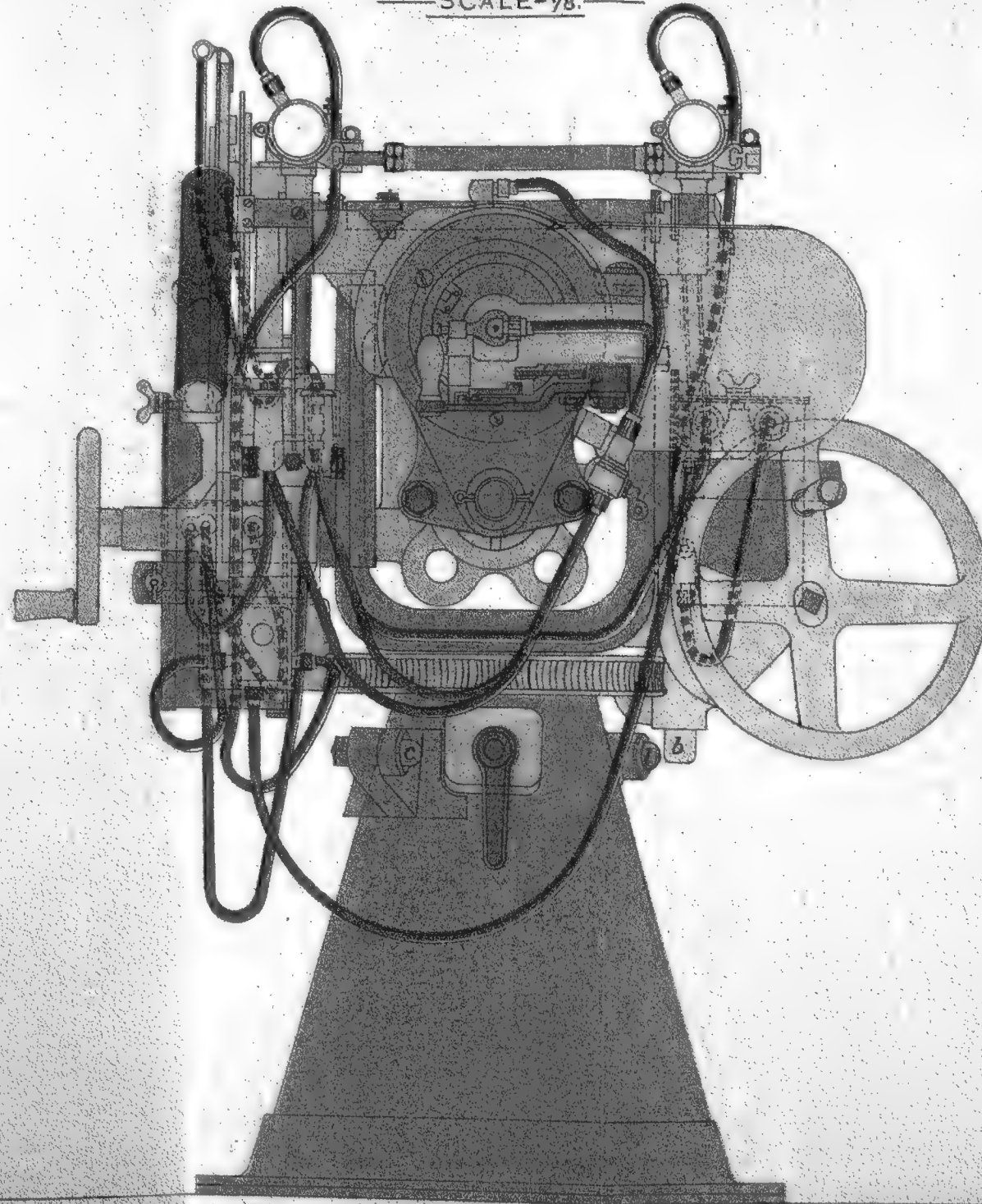
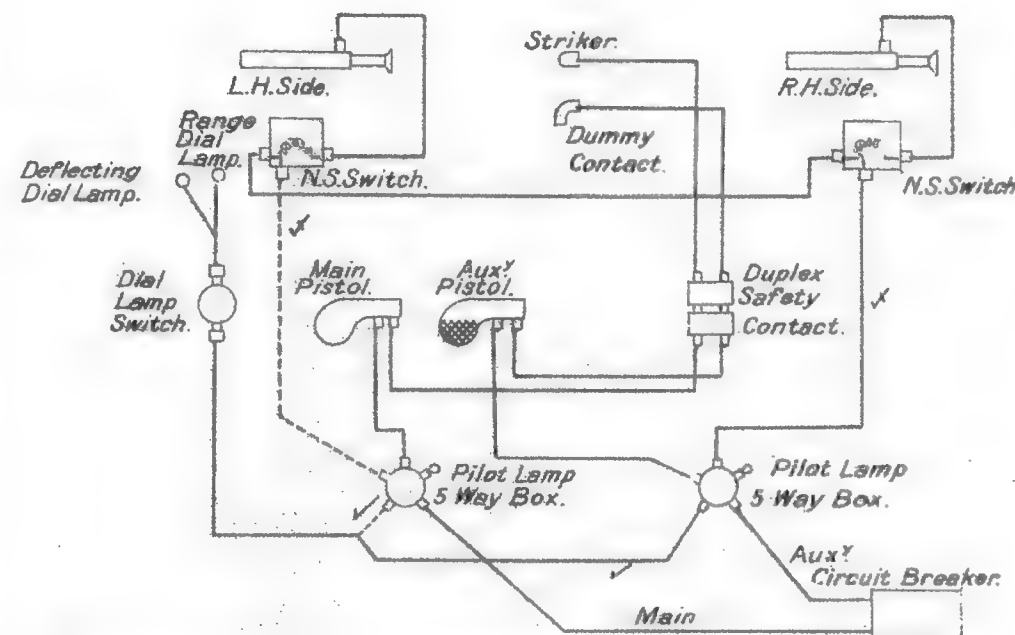


DIAGRAM OF PIV* CIRCUITS FOR DYNAMO FIRING.

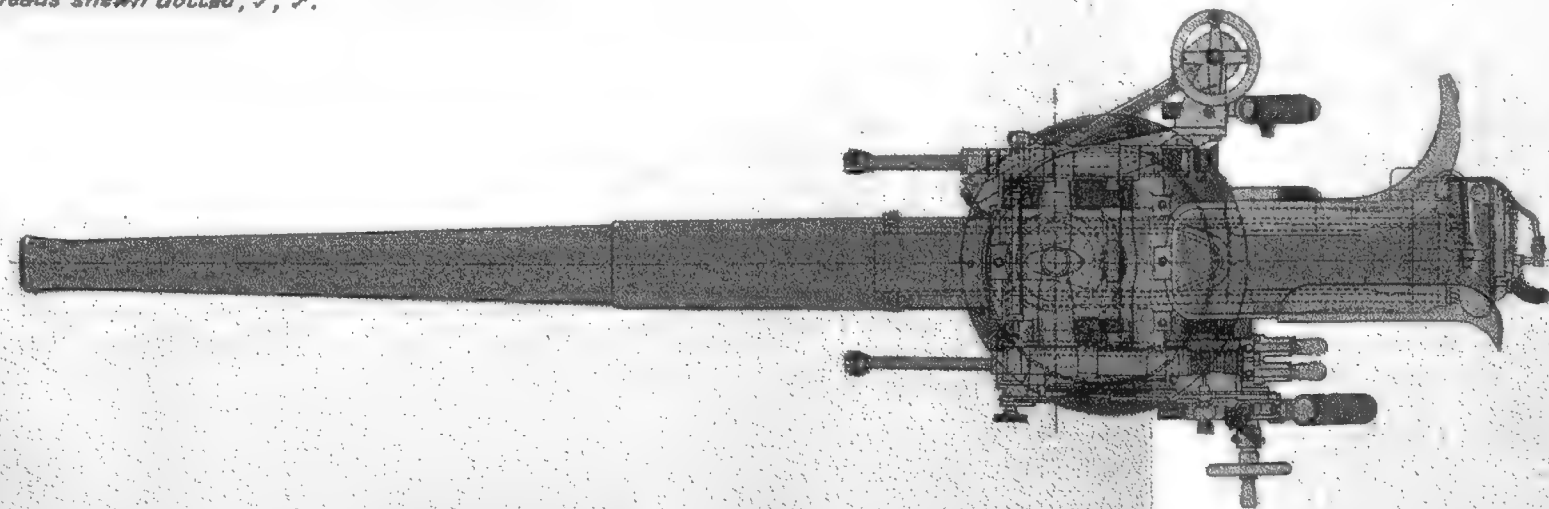


Alternative positions for leads shown dotted, /, x.

12 P^R MOUNTING P MARK IV*

Scale 1/20.

PLAN.



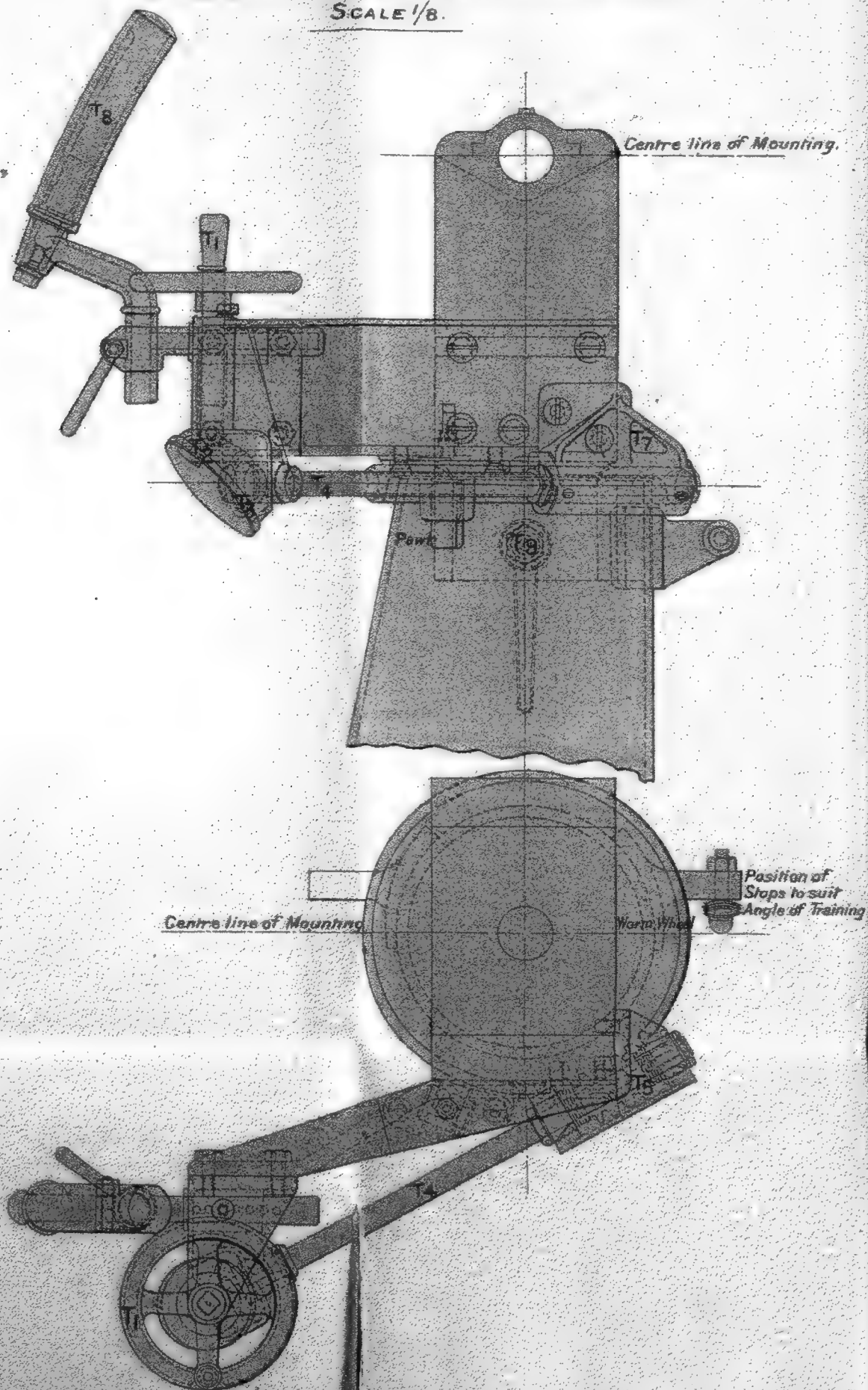
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e National Archives' leaflets

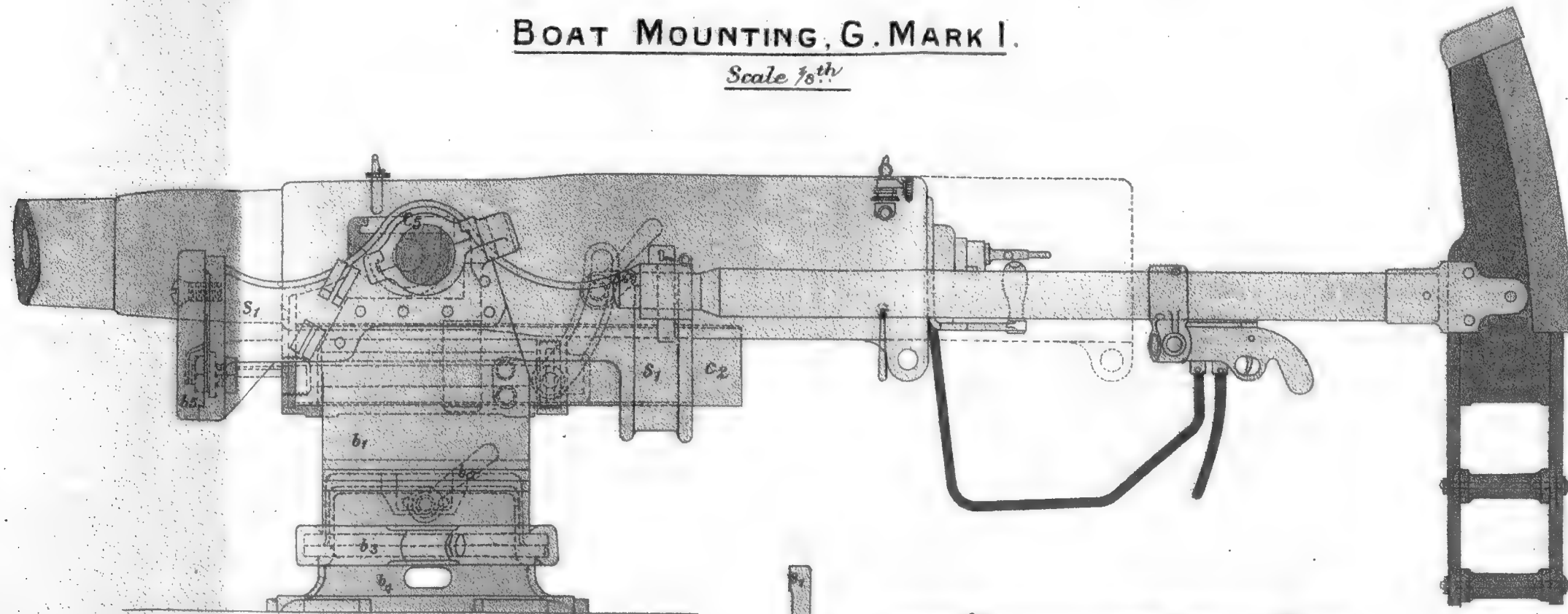
Plate XXIV

12 PR MOUNTING P. MARK IV.
ARRANGEMENT OF TRAINING GEAR.
SCALE 1/8.

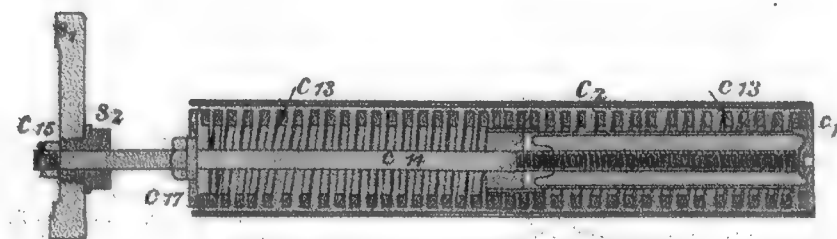


BOAT MOUNTING, G. MARK I.

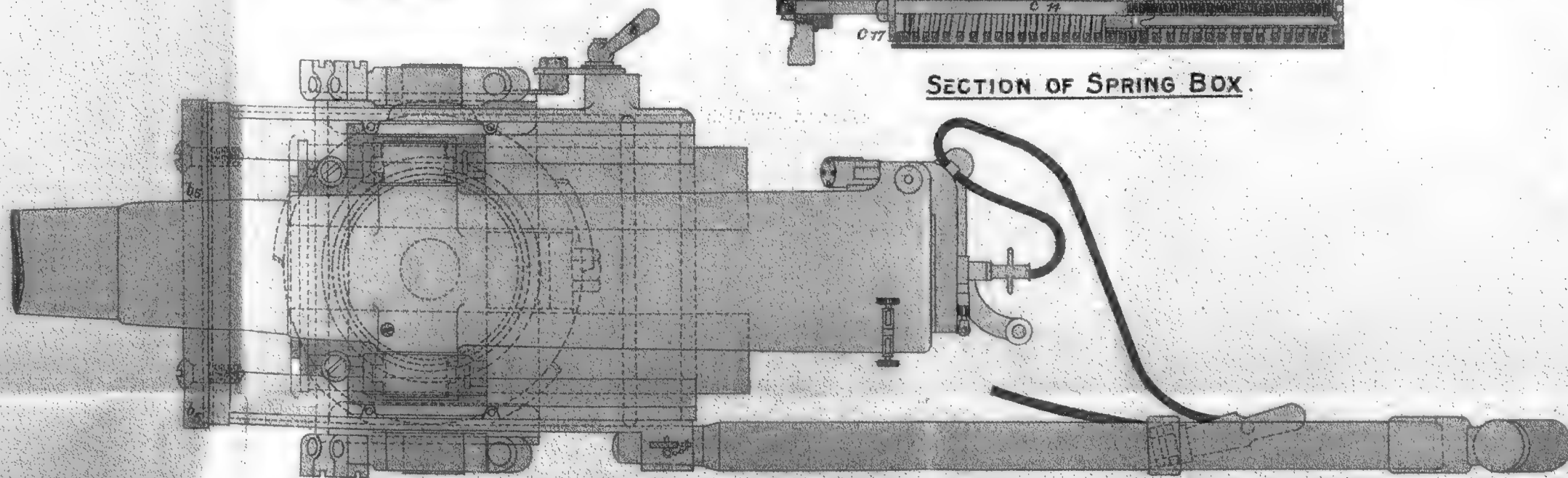
Scale $\frac{1}{8}$ "



ELEVATION.



SECTION OF SPRING BOX.



PLAN

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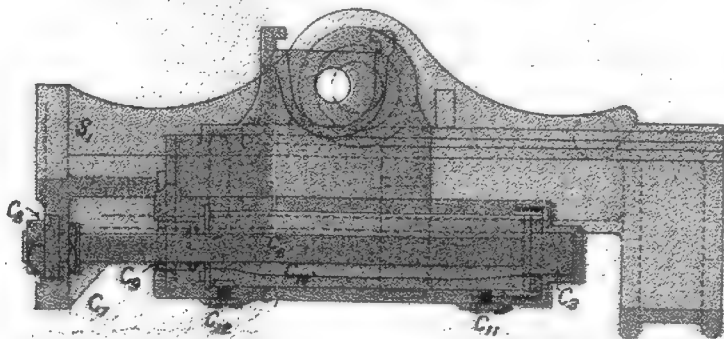
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Plate XXVI

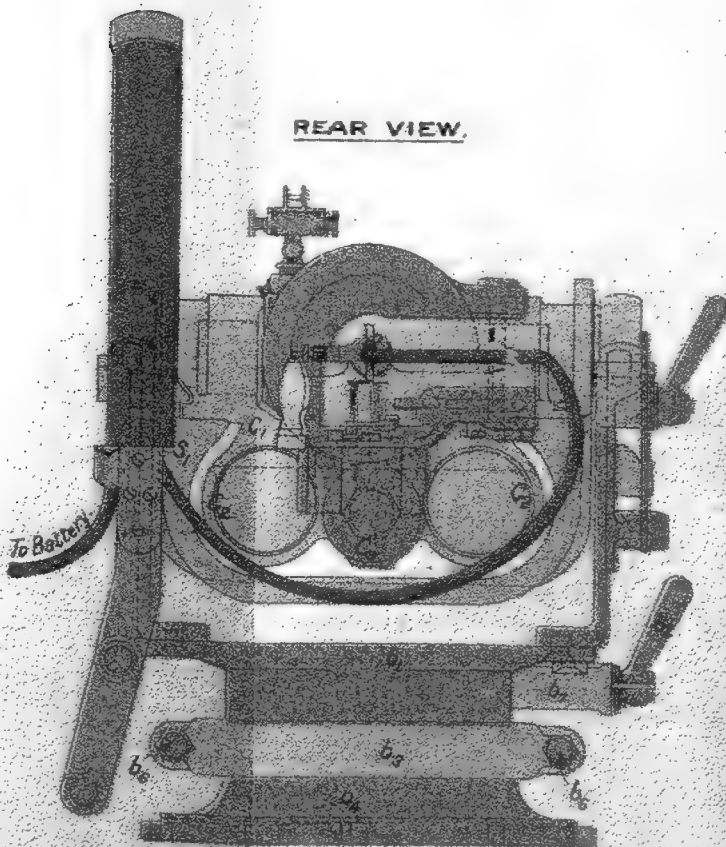
BOAT MOUNTING G MARK I.

SCALE $\frac{1}{8}$

SECTION THROUGH CYLINDER



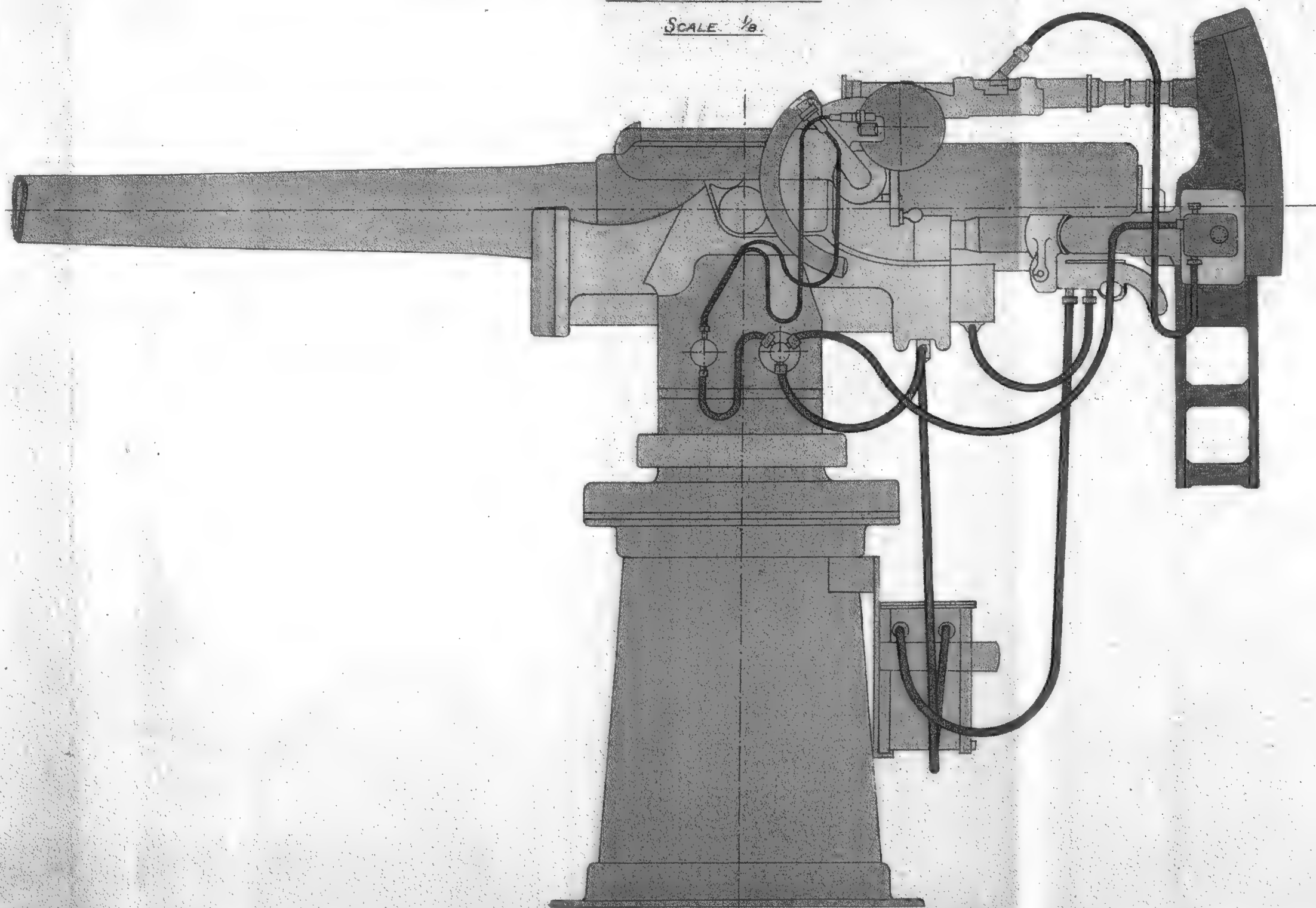
REAR VIEW



12 PDR 8 CWT. BOAT MOUNTING G MARK I.*

SIDE ELEVATION.

SCALE 1/8.



12 P^{DR} 8 CWT. BOAT MOUNTING G MARK I*.

PLAN.

SCALE 1/8.

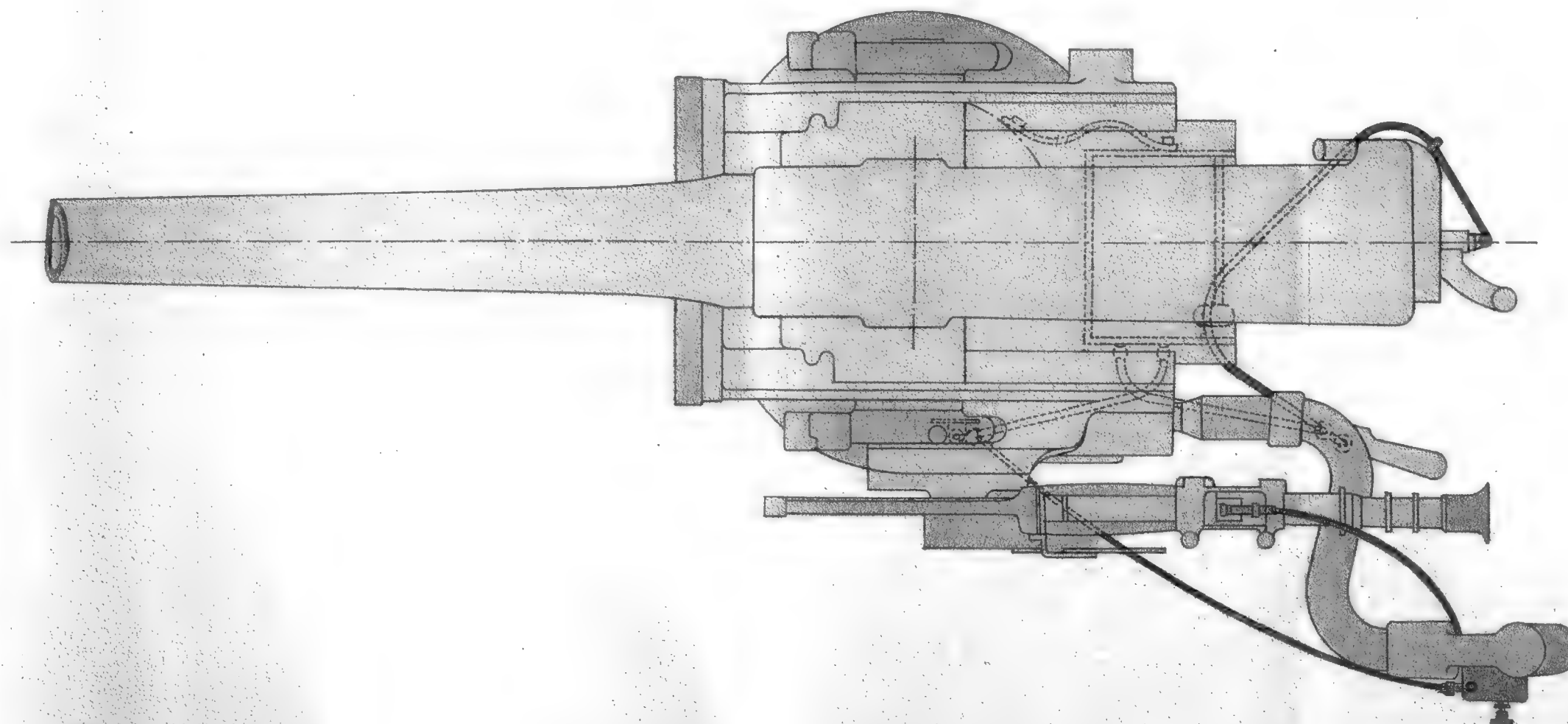
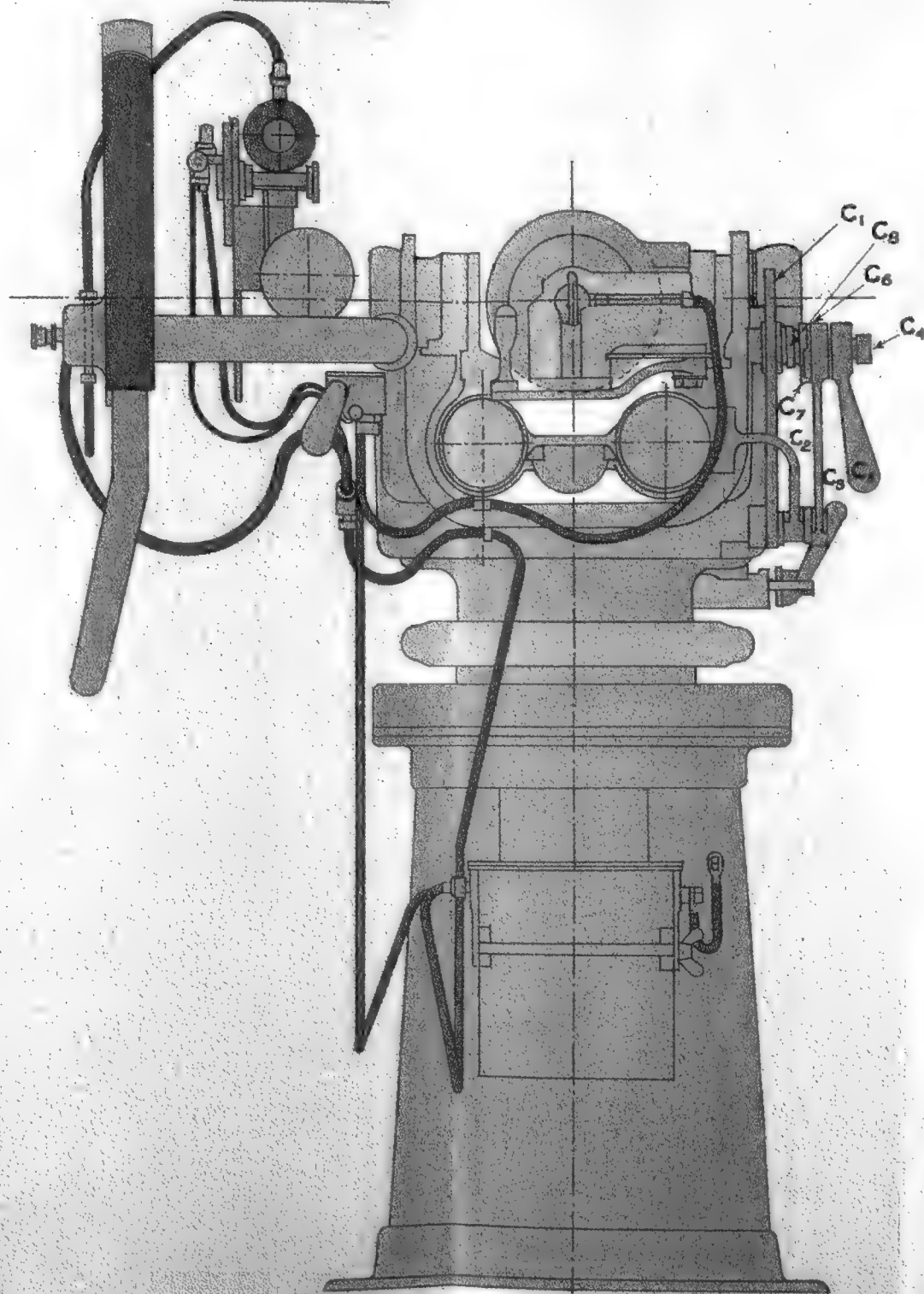


Plate XXIX.

12 P.D.R. 8 CWT. BOAT MOUNTING G MARK I.
END ELEVATION.

SCALE $\frac{1}{8}$.



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PLATE XXX.

THE FIELD CARRIAGE FOR 12-CWT. GUN.

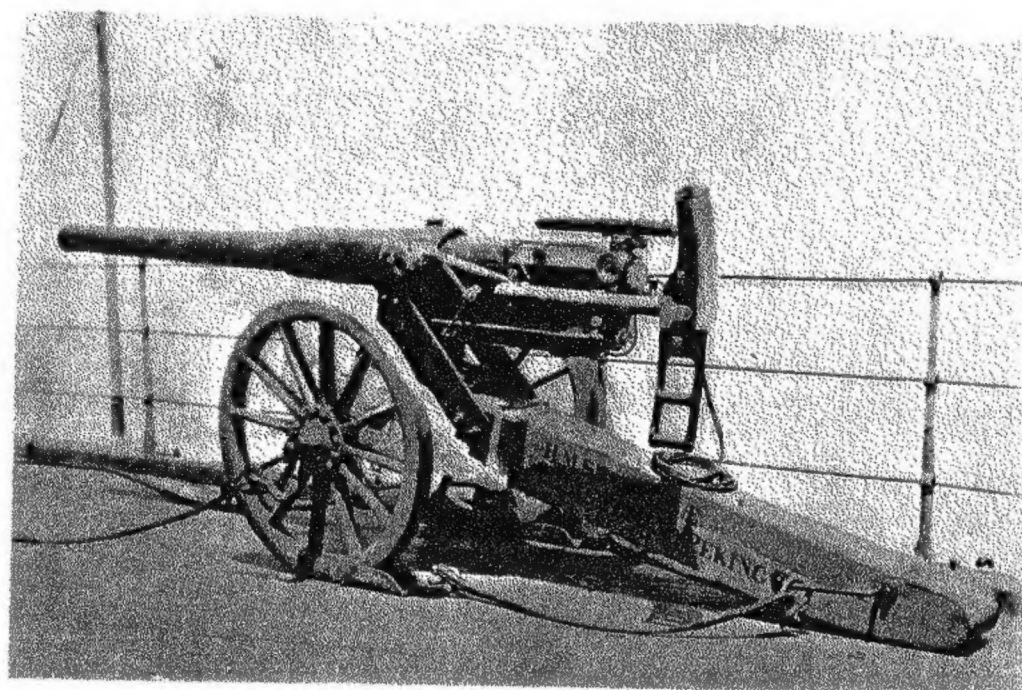
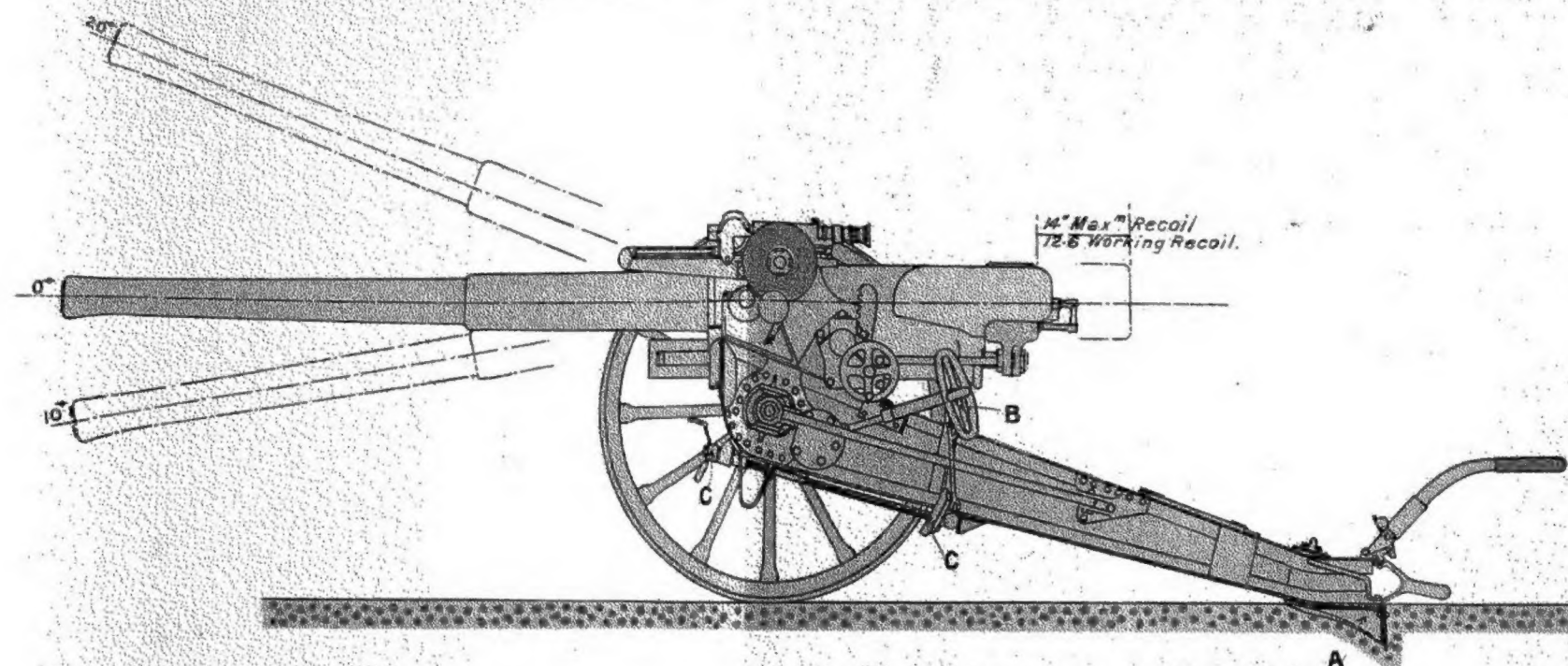
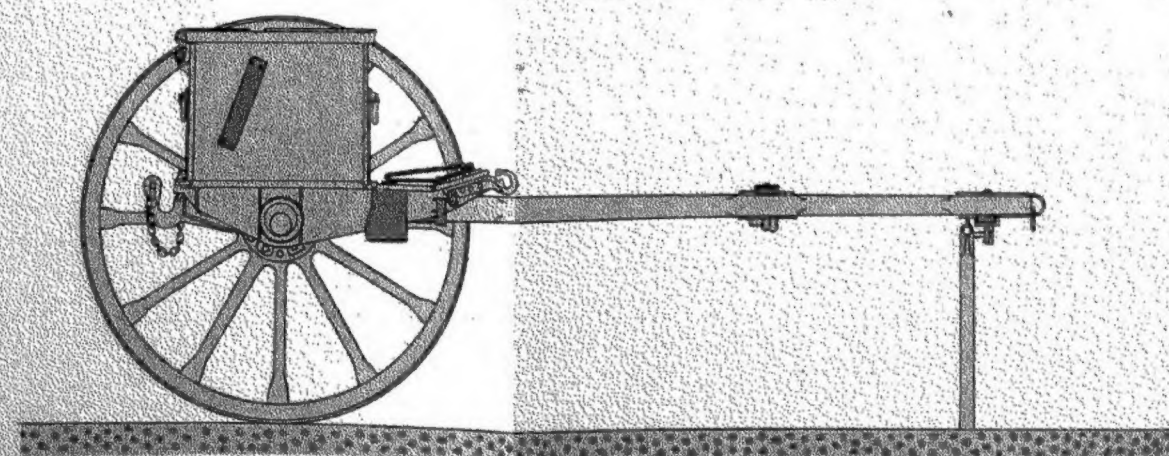


Plate XXXI

CARRIAGE, FIELD, Q.F. 12 PR 18 CWT. GUN. N.



LIMBER.

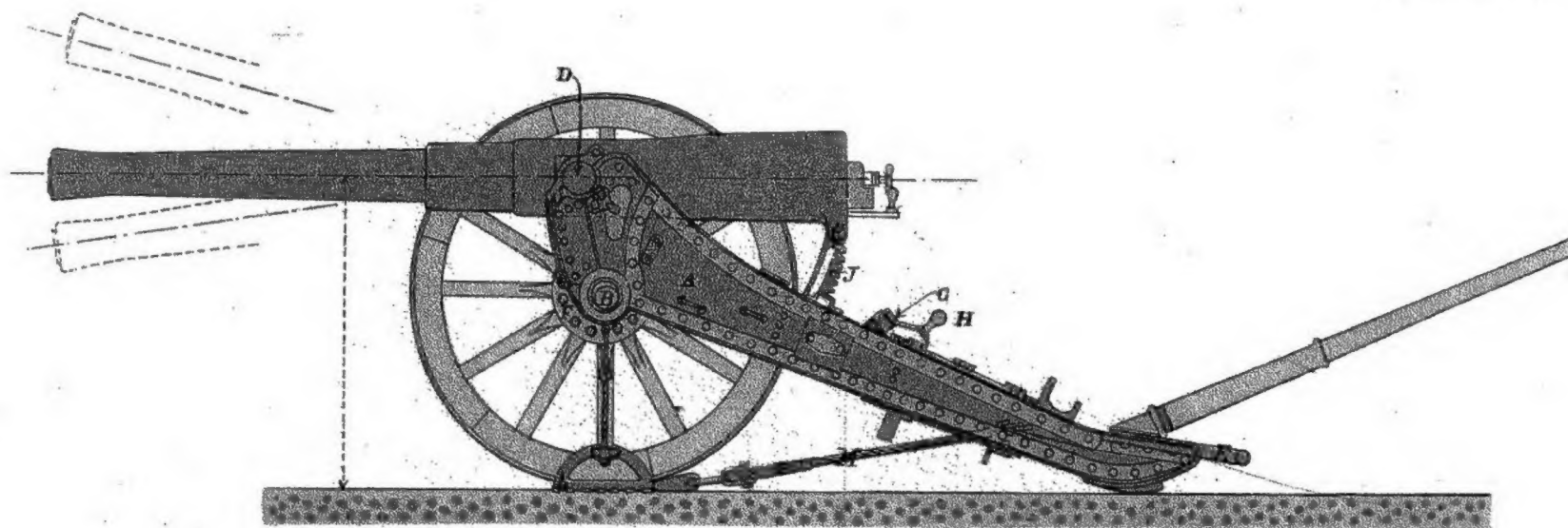


Scale
Inches 0 1 2 3 4 5 Feet

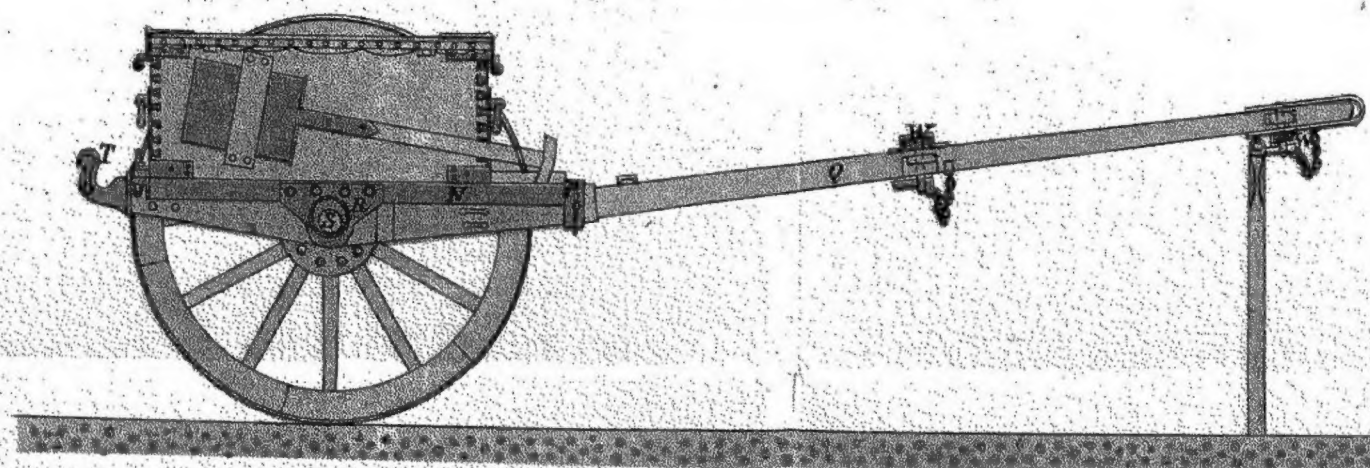
12 PR 8 CWT Q. F. GUN ON FIELD CARRIAGE

Scale 1/20.

NOTE *Elevating handle
is on the left.*



LIMBER.



NAVAL TRAVELLING CARRIAGE AND LIMBER FOR 12 P^R Q.F. GUN.

DIAGRAM SHOWING MODE OF PACKING STORES &c.

CONTENTS OF AMMUNITION BOXES

12, SHELLS, COMMON MARKED C.
12, D^R SHRAPNEL " S.H.
24, CARTRIDGES, Q.F. 12 P^R " C.Q.F.

12, FUZES TIME AND PERCUSSION
MARK IV (IN 12 CYLINDERS)

STORES ON LIMBER

1, PAIR ROPES, DRAG, LIGHT
1, SWINGLETREE.
1, SPADE.
1, AXE, HAND 2 LBS.
1, HOOK BILL.
1, AXE, PICK, 5 LBS HELVED
2, BUCKETS, WATER, 6 S.
2, SLATS
1, BOX GREASE

PLAN OF AMMUNITION BOXES WITH LIDS OPEN.

ON INSIDE OF LEFT LID
IN LEATHER POCKETS.

1, PIN, LINCH.
1, SIGHT, TANGENT
1, SIGHT, FORE
1, SIGHT SOCKET
1, KEY, FUZE UNIVERSAL

UNDER PLATFORM IN
LEFT LIMBER BOX

4, PORTFIRES, COMMON
2, LBS. SLOWMATCH

UNDER PLATFORM IN
RIGHT LIMBER BOX.

1, WASHER DRAG FOR GUN.

IN SPACE R.

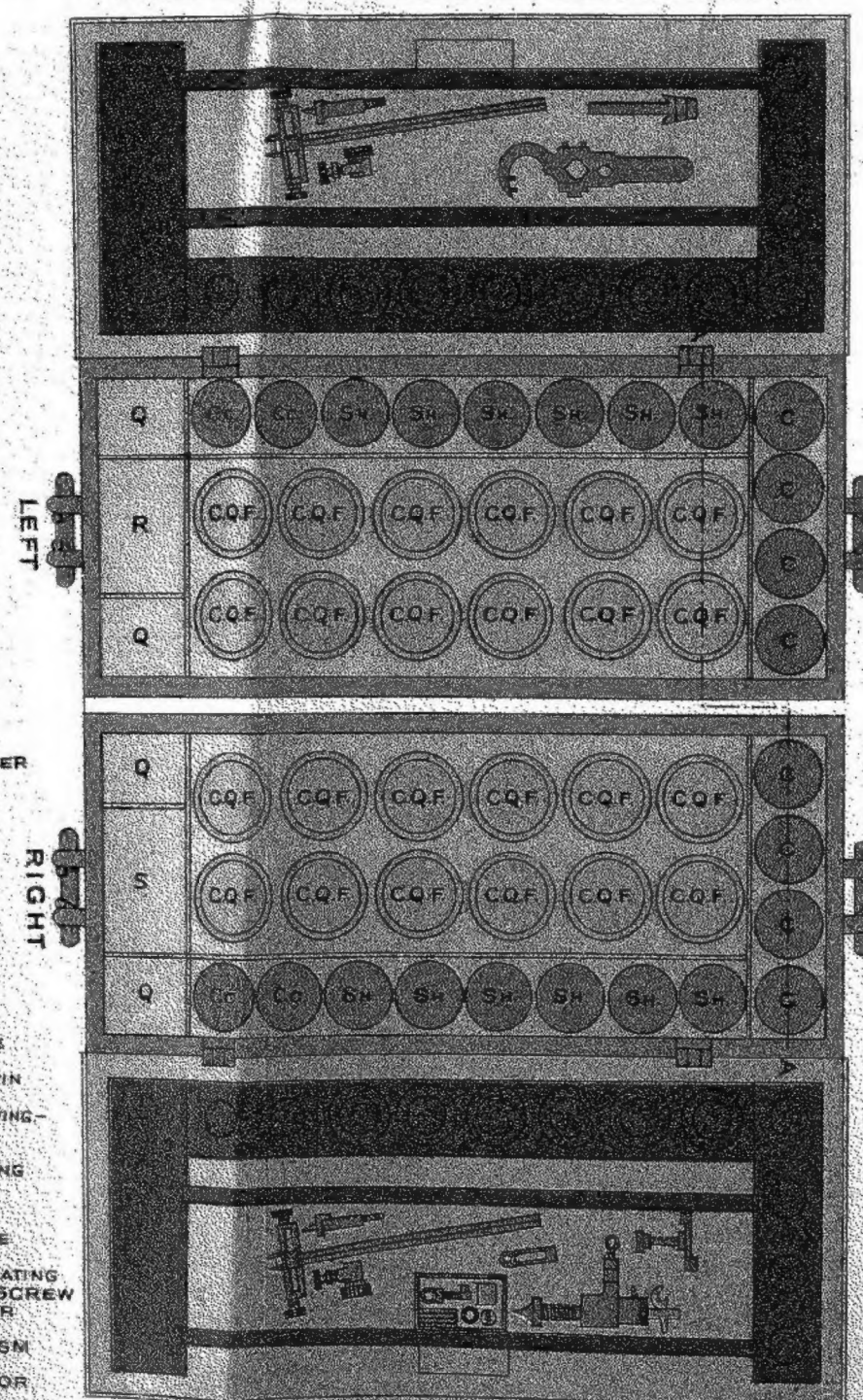
1, POCKET TUBE
1, STRAP TUBE BOX LONG
20, TUBES, PERCUSSION
(3 BOXES)
1, LANYARD, SIDE FIRING

IN SPACE S.

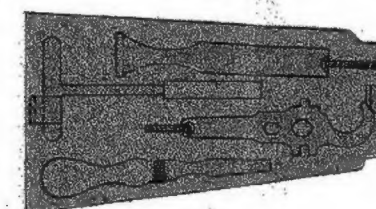
1, WASHER DRAG FOR LIMBER
1, CLEANER, PIASABA
WITH LANYARD
1, CLEANER, WOOL WITH
LANYARD
1, " SIDE FIRING

ON INSIDE OF RIGHT LID
IN LEATHER POCKETS.

1, SIGHT TANGENT
1, SIGHT SOCKET
1, SIGHT FORE
1, STRIKER, ELECTRIC AND
PERCUSSION COMPLETE
1, SAFETY STOP
1, ELEVATING BOLT KEEP PIN
1, BOX OF SMALL STORES
CONTAINING THE FOLLOWING—
TRIGGER COMPLETE
1, BUSH, SLIDING BLOCK
1, SPRING, CATCH RETAINING
BREECH SCREW OPEN
1, SCREW PRESERVING
FORE SIGHT
2, PINS, KEEP BOLT HINGE
CARRIER
1, LINK ACTUATING
BREECH SCREW
1, NUT, LEVER
BREECH
1, MECHANISM
PIN, AXIS
1, EXTRACTOR



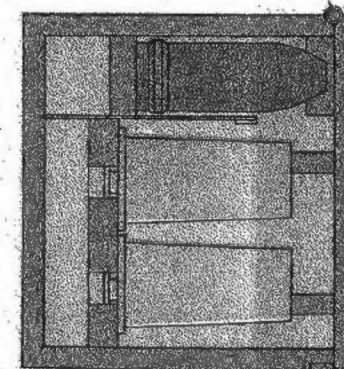
UPPER TRAY IN TRAIL BOX.



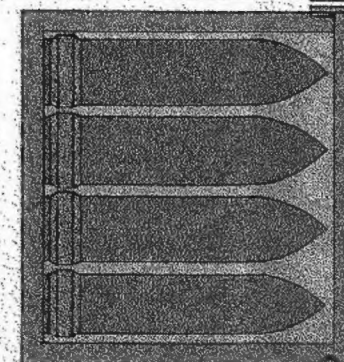
CONTENTS.

1, EXTRACTOR CARTRIDGE HAND
1, RIMER, VENT AXIAL, SHORT
1, KEY FUZE, UNIVERSAL
1, DRIVER, SCREW

SECTION OF BOXES ON A.A.

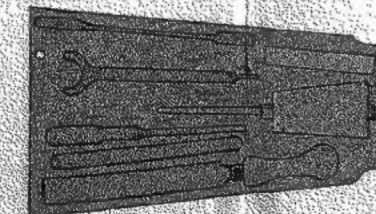


NEAR BOX



OFF BOX

LOWER TRAY IN TRAIL BOX



1, WRENCH, DISMANTLING "0"
1, " " "0" "2"
1, PUNCH
1, DRIFT
1, CAN, OIL
1, SPANNER, WITH SHIFTING JAW 5"
1, " " "ELEVATING GEAR
1, FILE, FLAT, BASTARD, 6"

1 2 cms
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